July, 1948

FOUNDRY

wherever metals are cast...

THE SPO 9000 SERIES

JOLT-SQUEEZE-CLAMP
ROLLOVER
DRAW MACHINE

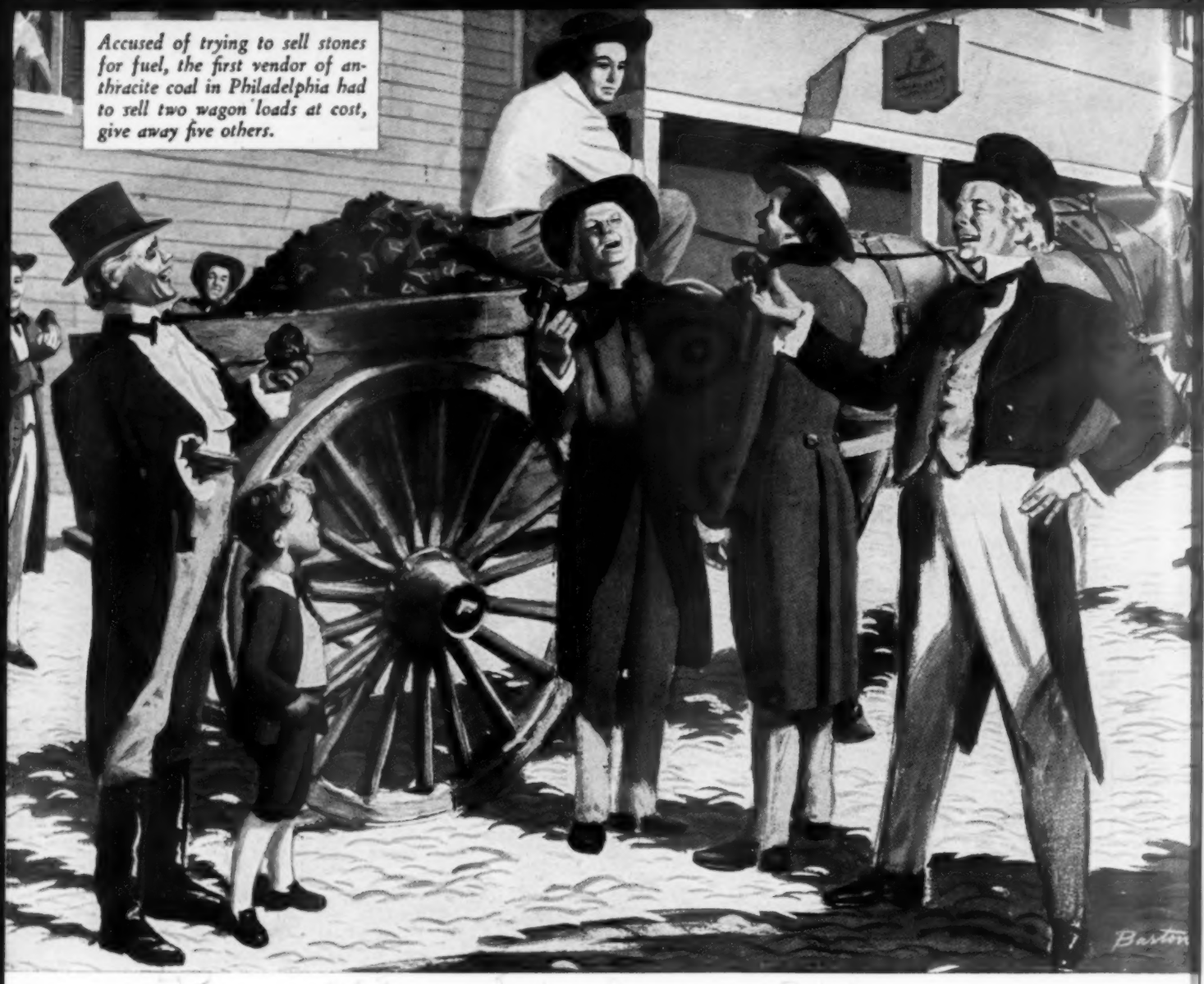
SPO "9000" Molding Machines have many features important to you in making more and better castings. Please write for complete information, describing your requirements fully.

MEMBER
FOUNDRY EQUIPMENT MANUFACTURERS' ASSOCIATION, INC.

Special Features

LARGE TRUNNIONS
EXCLUSIVE INVERTED CYLINDER CONSTRUCTION
HAND OR POWER OPERATED ROLLOVER OPERATION
POWER BRAKE

SPO INCORPORATED
7500 GRAND DIVISION AVENUE
CLEVELAND 5, OHIO


Accused of trying to sell stones for fuel, the first vendor of anthracite coal in Philadelphia had to sell two wagon loads at cost, give away five others.
Barton

"ANTHRACITE FOR FURNACE FUEL?"

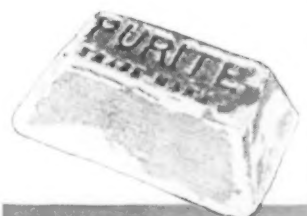
"NEVER!" said the iron makers of 1812

Even with important advantages over charcoal, anthracite needed 28 years for wide acceptance by iron makers. First offered in 1812, it wasn't until 1840 that Dr. Geissenhainer's principle of using anthracite with a hot blast was generally accepted. By 1890, the industry was producing 2,186,411 tons of anthracite iron a year.

In striking similarity was the reception given to PURITE. Placed on the market only 25 years ago, PURITE is now employed in the production of over 10,000,000 tons of castings annually. Here is why:

PURITE forms a sodium slag which is more fluid, more highly basic and of lighter gravity than ordinary cupola slags. This slag not only fluxes the cupola better, resulting in improved melting conditions, but converts particles of slag-oxides entrained in the iron into a liquid form, which frees itself from the molten metal. The result is cleaner iron and better castings.

For the facts on improved quality and lower operating costs, send for details about PURITE. Mathieson Chemical Corporation, 60 East 42nd Street, New York 17, N. Y.



PURITE is commercially pure soda ash containing over 98% sodium carbonate, fused and cast into convenient 2-lb. pigs. Its desulfurizing and refining action are traceable to the chemistry of soda ash.

Mathieson
PURITE

Purite (Fused Soda Ash) . . . Liquid Chlorine
Caustic Soda . . . Soda Ash . . . Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua
Sodium Chlorite Products . . . Chlorine Dioxide
HTH Products . . . Dry Ice . . . Carbonic Gas
Sodium Methylate

TECHNOLOGY DEPARTMENT

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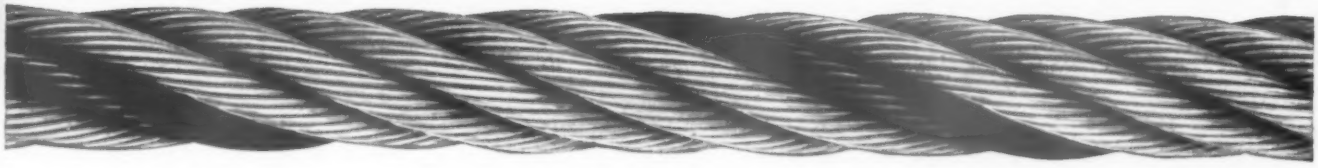
JUN 30 1948
DETROIT

TOUGH - *that's Purple Strand*

STRONG - *that's Purple Strand**

DURABLE - *that's Purple Strand**



* Purple Strand is Bethlehem's top-grade wire rope—the rope that is made in every size, type, and construction needed for foundry work. Whether you use small hoists or big overhead cranes, rig 'em with steel-sinewed Purple Strand. It will handle your ladles, flasks, and castings as if they were feathers.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
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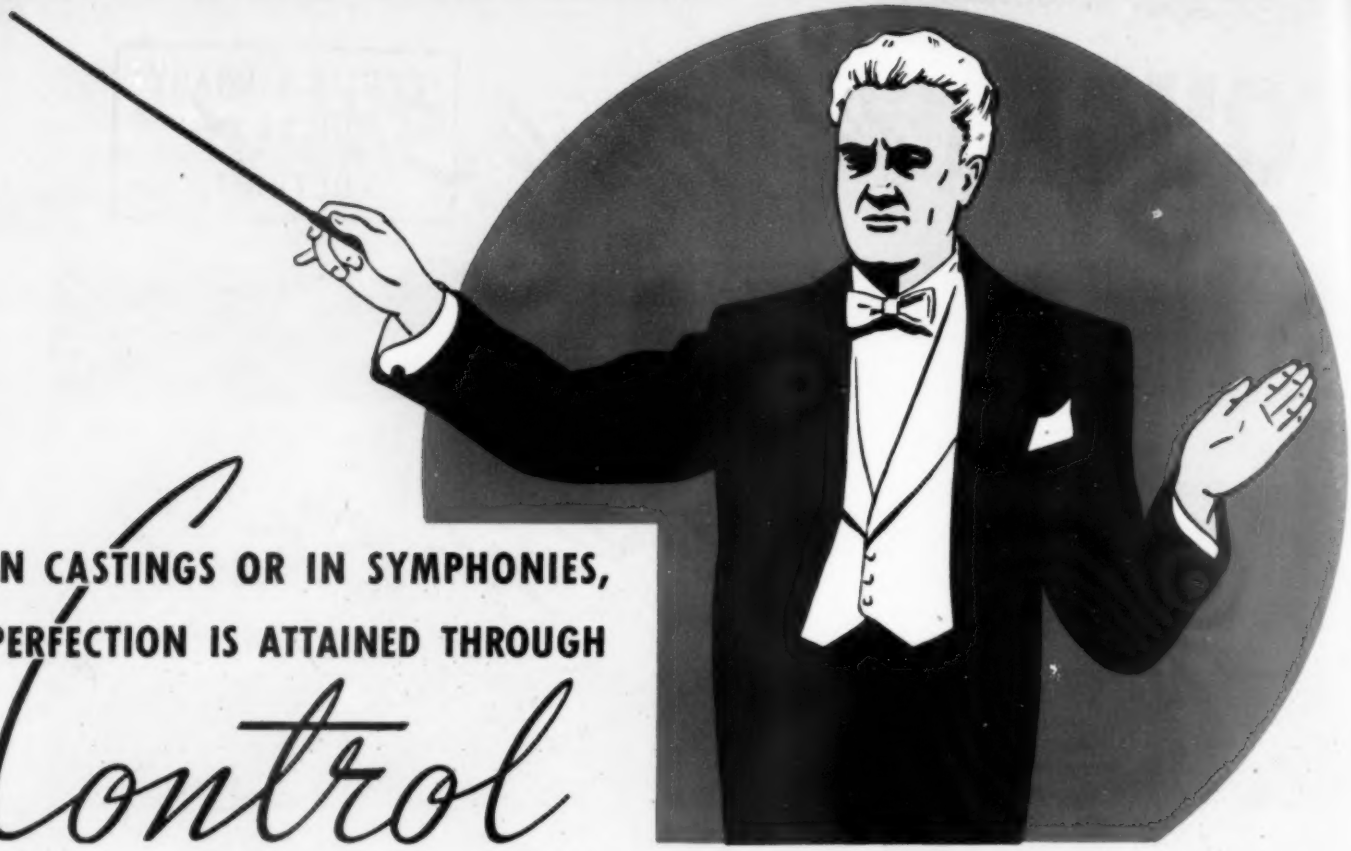
When you think WIRE ROPE . . . think BETHLEHEM



IN CASTINGS OR IN SYMPHONIES,
PERFECTION IS ATTAINED THROUGH

Control

GREEN BOND

If the strength and volume of a philharmonic orchestra were not controlled, the result would be chaos, or general pandemonium. If the strength of a molding sand were not controlled, there would be very little casting at a profit. FEDERAL GREEN BOND, processed from the finest Western Bentonite, is a definitely superior bond. It can be mixed to produce a firm, unyielding sand, or a sand that collapses readily and flows freely. There is no variation in the quality or uniformity of GREEN BOND—a shovelful from one bag, or an entire carload show the same properties and characteristics. Foundrymen like GREEN BOND after the first trial—after that, they are friends for life.

THE BEST OF THE BENTONITES

THE FEDERAL FOUNDRY SUPPLY COMPANY

4600 East 71st Street • Cleveland 5, Ohio

Seacoal Plant — Mines

CROWN HILL, W. VA. • CHICAGO • CHATTANOOGA, TENN. • DETROIT • MILWAUKEE • NEW YORK • ST. LOUIS • RICHMOND, VA. • UPTON, WYO

The Foundry Supply Co., Inc., 2295 University Ave., St. Paul 4, Minn. • Beaumont Cement Sales Co., Houston and Beaumont, Texas, and Harvey, La. • Chamberlain Company, Los Angeles, Calif. • Pacific Graphite Works, Oakland, Calif. • LaGrand Industrial Supply Co., Portland, Ore.

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JULY, 1948

THE FOUNDRY

VOLUME 76—NUMBER 7

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POURING OFF. NOTICE THE UNHINDERED PERMEABILITY.

LINOIL

DRY SAND MOLDING CAN CUT COSTS!

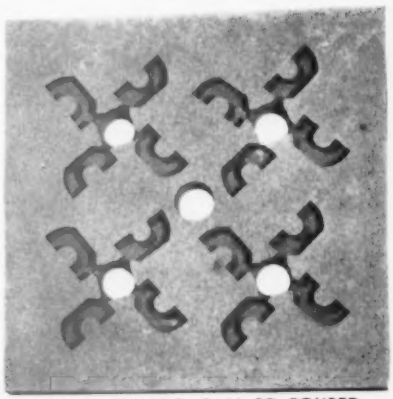
THE ARNOLD ENGINEERING CO.
MARENGO, ILLINOIS

Permanent Magnets for radio, aviation, automotive, and communication instruments are made of a special alloy called "Alnico" (a coarse grained, hard, brittle metal) which cannot be milled, machined, or turned by production methods. Instead, these magnets must be cast to exceptionally close tolerances and then sized by abrasive grinding.

Tolerances of 1/64 to 3/64" are attained by dry sand molding — but are not possible in green sand. Hence, dry sand molding solves their machining problem, and the pouring of multiple castings in vertically stacked molds permits greatly increased casting production on limited floor space.

Increased production is probably the most common reason for dry sand molding. By stacking molds of core sand vertically, more castings per unit of area can be poured. Dry sand permits closer tolerances, more accurate dimensions — resulting in reduced machining. Cleaner castings with smoother surfaces are also attained. Better sand control is afforded, since only one type sand is required. Dry sand cores are usually much more permeable — thus better venting is allowed. Jobbing shops with small-lot orders often find it cheaper to cast in core molds rather than buy one specially-built flask.

Wherever dry sand molds are employed — the high binding strength, economy, and uniformly reliable performance of LINOIL cores is always a definite advantage to successful casting.



16 CASTINGS CAN BE POURED ON ONE PLATE

CASTINGS CLEAN OUT READILY

ASSEMBLYING THE COPE HALF OF CORE PLATE.

THE LINOIL — THE LOGICAL OIL

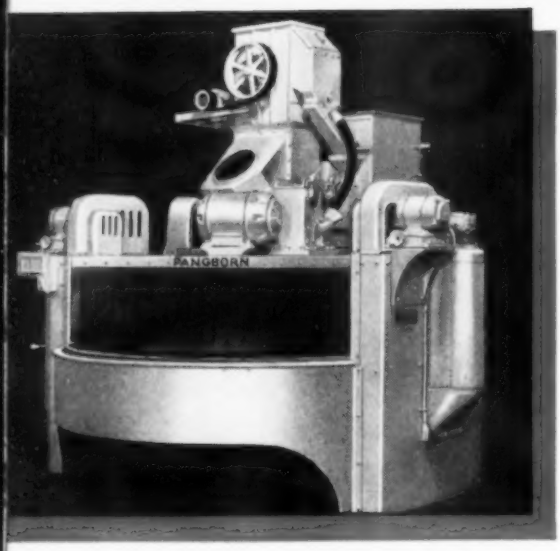
THE WERNER G. SMITH COMPANY
(DIVISION OF ARCHER-DANIELS-MIDLAND COMPANY)

2191 WEST 110th STREET · CLEVELAND 2, OHIO

Whatever Your Blast Cleaning Problem

PANGBORN Has the Righ

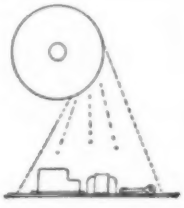
Pangborn ROTOBLAST Tables



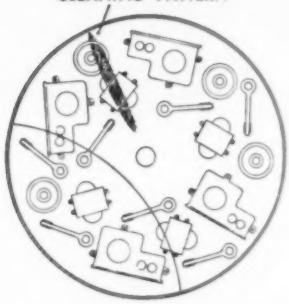
TYPE "LF"

One of the two basic type Pangborn ROTOBLAST Tables is this model "LF" Single Type Standard Table Installation. Work is placed on the Table level, passing through the blast stream in fixed position as the Table rotates. The ROTOBLAST stream, thrown at 90° to the plane of the work, permits pieces to be placed close together on the Table due to the concentration of the stream and greater target area presented by the work.

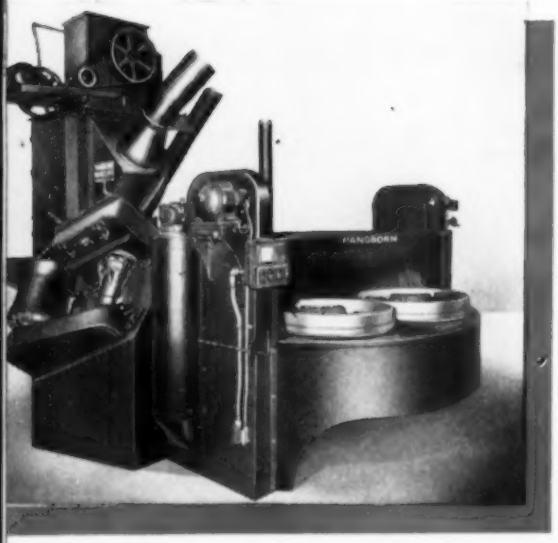
BLAST STREAM AT 90° ANGLE



CLEANING PATTERN



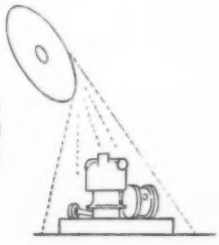
Here is production blast cleaning of high efficiency for flat-surfaced work. Faster, cheaper, cleaner is the Pangborn method, meeting the ever-changing demands of industry. This type machine offers full freedom to the operator, outside of the blast-cleaning enclosure. It permits full use of modern devices for material handling. One user, the Florence-Wehrle Stove Co., Newark, Ohio, states, "Our 8 foot Pangborn Standard ROTOBLAST Table enables us to clean 3,000 pounds of green ware, 1,600 pounds of enamelware and 700 pounds of de-enameling per hour."



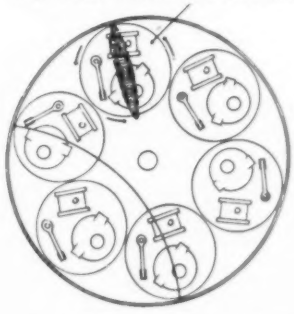
TYPE "LG"

The Pangborn "LG" has the added advantage of Auxiliary Work Tables. As these Tables pass through the ROTOBLAST stream on the Main Table orbit, they revolve around their own independent axels and bring all exposed surfaces (horizontal and vertical) into direct impingement with the blast stream, resulting in thorough, uniform cleaning.

BLAST STREAM AT 45° ANGLE SPINDLE REVOLVES IN STREAM



WORK ON REVOLVING SPINDLES



For outstanding performance in cleaning work with deep pockets, intricate contours, and multisurfaces, this design Pangborn "LG" Type ROTOBLAST Table is excellent. Since the blast stream is hurled at 45° to the plane of the Table, and the Auxiliary Work Tables rotate beneath it, all exposed surfaces are quickly cleaned down to virgin metal. Another Pangborn user, a large heater manufacturer, cleans heavy, intricate castings at the rate of 40-50 tons in a 7½ hour day using a Pangborn "LG" Table.

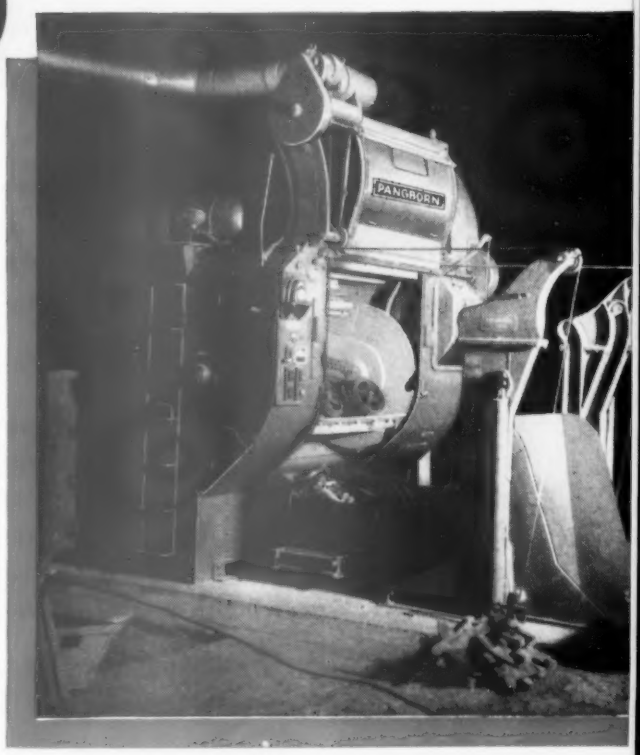
PANGBORN TABLES ARE AVAILABLE IN DIAMETERS OF 6, 9, 10, 12, 15 FEET

Pangborn

Equipment for Every Job . . .

Pangborn ROTOBLAST *Barrels*

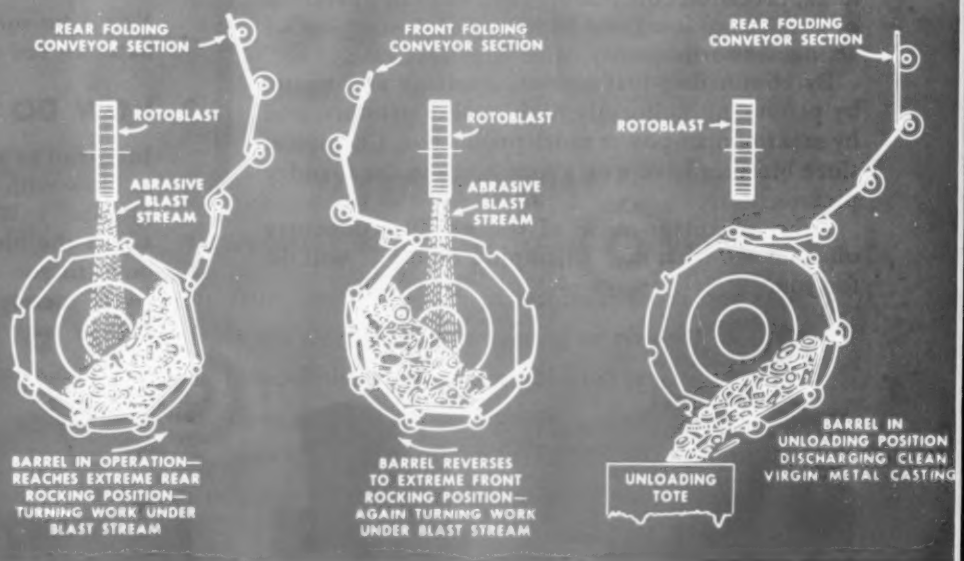
Current users of Pangborn ROTOBLAST Barrels report enthusiastically the savings in man-hours, the increase in cleaning output, the improved consistent uniformity of cleaning, and drastically cut over-all cleaning costs that are directly traceable to these machines. The exclusive design feature of Pangborn Rocking Action has proved to be an efficient way of completely turning work, as well as untangling shapes that tend to interlock or "nest."



AVAILABLE IN CAPACITIES OF 3½, 7, 14, 17½, 21, 28 CUBIC FEET

WRITE TODAY for information on all Pangborn Blast Cleaning and Dust Control Equipment. Address: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Maryland.

HERE'S HOW PANGBORN EXCLUSIVE ROCKING ACTION TURNS OUT PRODUCTION


REAR FOLDING CONVEYOR SECTION
ROTOBLAST
ABRASIVE BLAST STREAM
BARREL IN OPERATION—REACHES EXTREME REAR ROCKING POSITION—TURNING WORK UNDER BLAST STREAM
FRONT FOLDING CONVEYOR SECTION
ROTOBLAST
ABRASIVE BLAST STREAM
BARREL REVERSES TO EXTREME FRONT ROCKING POSITION—AGAIN TURNING WORK UNDER BLAST STREAM
REAR FOLDING CONVEYOR SECTION
ROTOBLAST
BARREL IN UNLOADING POSITION DISCHARGING CLEAN VIRGIN METAL CASTING
UNLOADING TOTE

BLAST CLEANS CHEAPER

with the right equipment for every job

Champion

TO BETTER

A NEW MACHINE INTRODUCED *A NEW WAY* GIVES EVERY FOUNDRY AN OPPORTUNITY TO "CHAMPION-IZE" FOR HIGHER QUALITY AT LOWER COSTS.

IF you have been debating the question of installing core blowers, this message is intended especially for you. A new model Champion core blower, the "Junior", just announced to the industry, has the answers to your questions:

A CHAMPION BLOWS BETTER CORES FASTER, EASIER, AT LOWER COST!

From the giant CB-400 down to the CB-5 ("Junior"), the same advanced engineering features, precision construction and smooth operation of any Champion Core Blower give instantaneous action, uniform quality, with effortless ease.

By eliminating lost motion, spoilage and waste, by producing uniformly high quality product, and by making man-power more productive, Champion Core blowers have won a firm place in the foundry picture.

Take advantage now of the new introductory offer, to see what the "Champion Method" will do for you.

1. IS CORE BLOWING PRACTICAL FOR ME?

With the "Junior" machine, even the smallest foundry which produces duplicate castings will find it worthwhile to blow their cores.

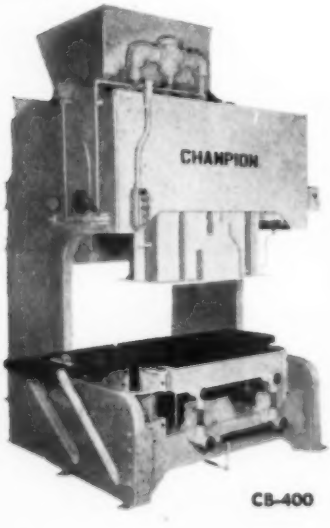
At a small investment, you have all the features of speed, uniformity and ease of handling that are characteristics of the largest model Champion.

2. HOW LONG DOES IT TAKE TO CHANGE OVER?

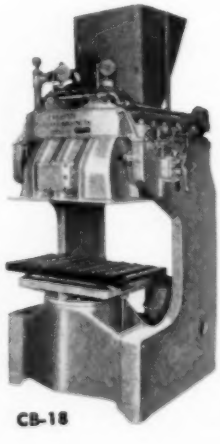
You'd be surprised! The introductory plan eliminates all red tape and unnecessary delay.

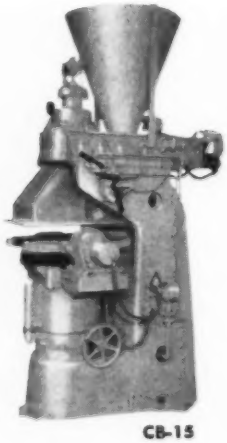
3. HOW DO I GO ABOUT IT?

Just send us a metal core box for the core you wish to blow with your order for a Champion CB-5 (the "Junior"). We will prepare the box for blowing, adjust the blower to the box, and ship the whole outfit to you without delay. When the machine arrives, merely connect your air pressure, fill the hopper with sand, and you're ready to go!

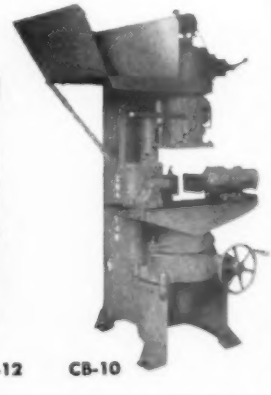


CB-400


CB-18


CB-15

CB-12


CB-10

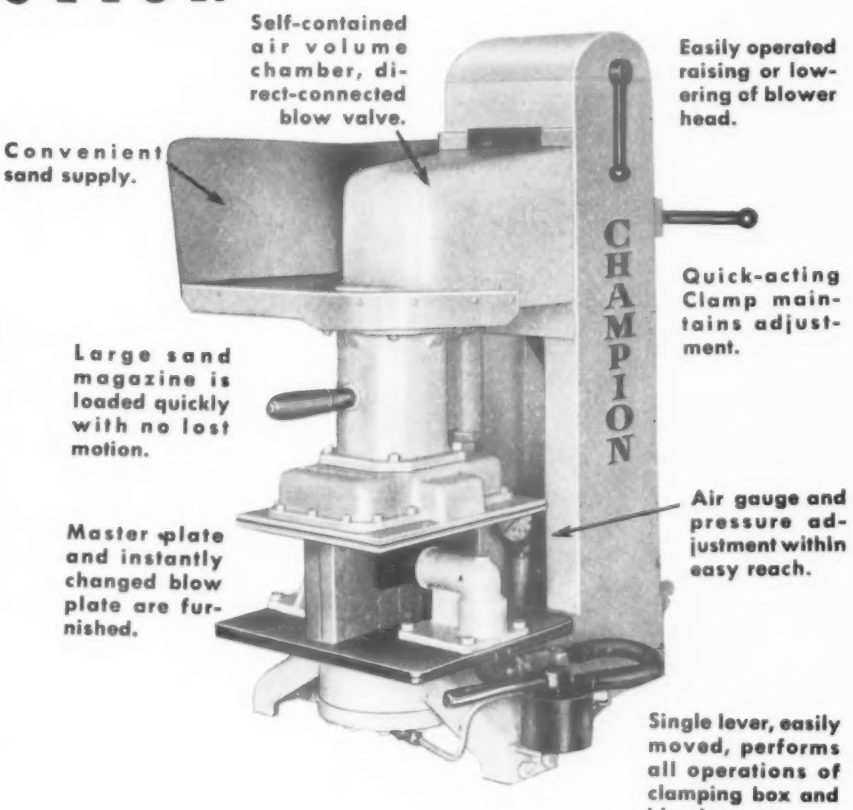
Clears the Way!-

ORE PRODUCTION

"JUNIOR"

S A TRUE CHAMPION WITH ALL CHAMPION FEATURES

There's really so little work required hat many foundrymen have difficulty believing their eyes, when they first ry out a Champion. With the left and, swing the head under the hopper and fill the magazine with sand. Then swing it back in blowing position, with box in place. A simple easy movement of the valve lever instantly operates both horizontal and vertical core box clamps and blows the core.


Self-contained air volume chamber, direct-connected blow valve.
Easily operated raising or lowering of blower head.
Convenient sand supply.
CHAMPION
Quick-acting Clamp maintains adjustment.
Large sand magazine is loaded quickly with no lost motion.
Air gauge and pressure adjustment within easy reach.
Master plate and instantly changed blow plate are furnished.
Single lever, easily moved, performs all operations of clamping box and blowing core.

NY AIR LINE WITH 85 LBS. PRESSURE S ADEQUATE TO OPERATE ANY CHAMPION CORE BLOWER.

gain HERE'S ALL YOU HAVE TO DO:

end us a core box to be used with a B-5 core blower, along with your rder. The machine will be shipped o you *ready to operate.* Merely supply ir at 85 lbs. and sand.

• • •

hampion engineers and production pecialists are glad at all times to give ou the benefit of their long expeience in helping you solve any mold r core making problems.

"JUNIOR"

IS ESPECIALLY ADAPTABLE TO SHORT RUNS

To change from one core box to another, from one type to another, is the work of only a second or two. Blow plate is instantly removable, without use of bolts, screws, clamps or latches. Base plate with air-operated clamps for vertically split boxes, is also instantly removable by merely lifting it off; no tools needed, no mechanical fasteners involved.

CHAMPION FOUNDRY AND MACHINE COMPANY

SALES OFFICE: 1553 W. MADISON ST. CHICAGO 7, ILLINOIS

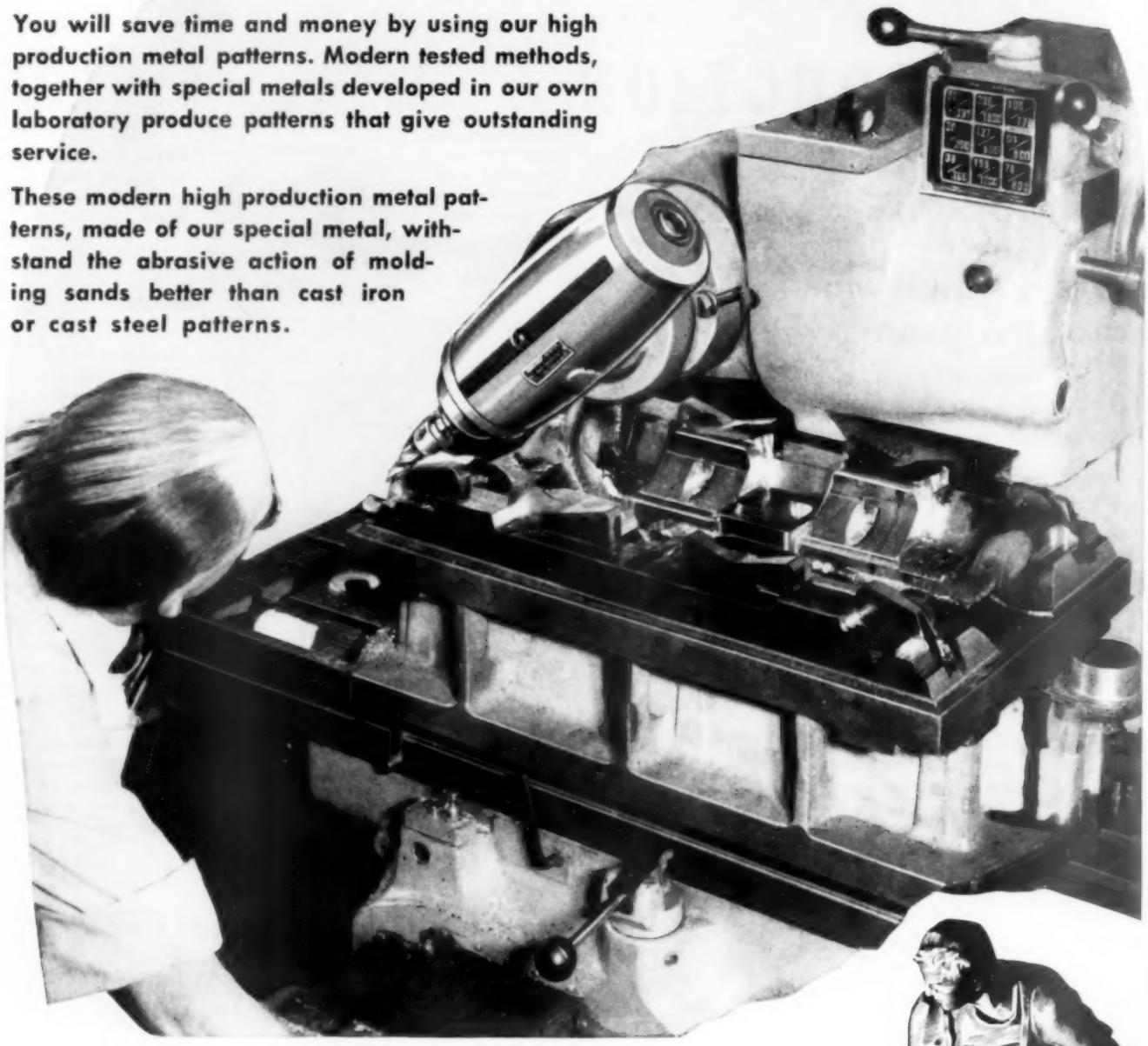
GENERAL OFFICE AND PLANT: ROCKFORD, ILLINOIS

MOLDING MACHINES CORE BLOWERS THE ELECTRIC RIDDLE

DESIGNERS, ENGINEERS AND MANUFACTURERS OF HIGH PRODUCTION PATTERNS

You will save time and money by using our high production metal patterns. Modern tested methods, together with special metals developed in our own laboratory produce patterns that give outstanding service.

These modern high production metal patterns, made of our special metal, withstand the abrasive action of molding sands better than cast iron or cast steel patterns.



PERMANENT MOLDS · WOOD AND METAL PATTERNS · KELLER AND DUPLICATOR WORK · MACHINE WORK · MALLORY METALS BERYLLIUM COPPER · MONEL METAL · EVERDUR CASTINGS COPPER CASTINGS OF HIGHEST ELECTRICAL CONDUCTIVITY · BRASS, BRONZE AND ALUMINUM CASTINGS

CITY PATTERN
FOUNDRY AND MACHINE CO.

1161 HARPER
AT RIVARD
DETROIT 11,
MICHIGAN

SPECIFY "ALLIS-CHALMERS" FOR—

"Certified" Motor Service!

Independent Local Repair Shops Now Being Selected to Give Better, Faster Service — "Certified" Parts and Workmanship—on Allis-Chalmers Motors— Transformers — Controls — and Pumps!

THE NAME "ALLIS-CHALMERS" has always meant good motors, generously built for long life! Now you have an *added* reason for investing in Allis-Chalmers motors . . .

BETTER SERVICE

Throughout the U. S. qualified motor repair shops are being selected and authorized as Allis-Chalmers *"Certified"* Service Shops. Each will have trained personnel as well as complete facilities for servicing and repairing Allis-Chalmers motors to original factory-established standards!

"CERTIFIED" Service Benefits You These Ways:

YOU GET FINEST PARTS. *"Certified"* Service Shops use genuine Allis-Chalmers repair parts — or parts of equal quality! Each shop is given complete service information, including factory procedure and drawings, if necessary. Result: factory-like workmanship!

YOU GET FINEST SERVICE. Every Allis-Chalmers *"Certified"* Service Shop has been selected on the basis of its excellent reputation in the community. It's the kind of shop you *like* to do business with!

How To Get Allis-Chalmers "CERTIFIED" Service:

Right now most Allis-Chalmers *"Certified"* Service Shops are located in the larger U.S. industrial areas. But they're rapidly expanding. For service, call your nearby A-C District Office, or Authorized Dealer. If we do not have a Service Shop in your locality, we will recommend the one closest to you. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. A 2498

NEW MOTORS AVAILABLE!

Many Sizes and Ratings of Allis-Chalmers Standard Squirrel-Cage Motors from 1 hp up are Now Available from Stock. Call Your A-C Authorized Dealer or District Office.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

DELTA PARTEX
NUT SHELL PARTING

SPEED CORE and MOLD PRODUCTION

DELTA PARTEX is a superfine, waterproofed powder made from selected pulverized nut shells. It contains no hazardous or harmful ingredients. It is safe and easy to use. It flows like water, dusts freely through the shaker bag and covers all surfaces uniformly.

DELTA PARTEX has the properties and characteristics of Lycopodium at only a fraction of the cost.

DELTA PARTEX works faster, saves time and lasts longer. Core boxes and patterns stay cleaner with fewer applications

DELTA PARTEX has uniform surface affinity for sand. It will not pile up in corners. It is non-reactive with molten metal and will neither pit nor etch metal pattern and core boxes. It will not contaminate or change the characteristics of core and molding sands.

DELTA PARTEX is EASIER, SAFER and MORE ECONOMICAL to use.

Ask for a liberal working sample for test purposes and prove to yourself the advantages of DELTA PARTEX in your foundry.

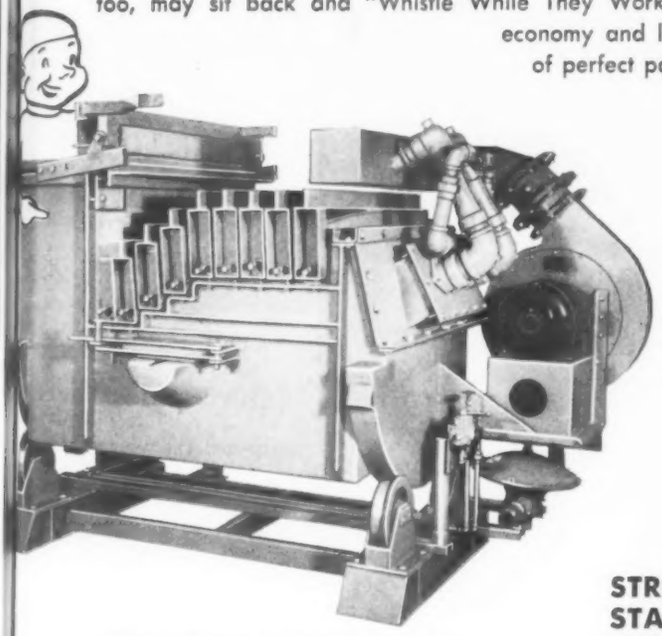
9 IMPORTANT REASONS WHY DELTA PARTEX IS MORE EFFICIENT AND MORE ECONOMICAL TO USE . . .

1. No silicosis hazard.
2. Has the properties and characteristics of Lycopodium.
3. Is non-reactive with molten metal.
4. Will not pit nor etch metal patterns and core boxes.
5. Will not contaminate nor reduce fusion point of core and molding sands.
6. Has uniform surface affinity for sand.
7. Leaves casting surfaces clean and free from contamination for plating work.
8. Is free-dusting through shaker bag.
9. Is moisture-resisting and will not deteriorate on aging.

DELTA OIL PRODUCTS CO.
MILWAUKEE 9, WISCONSIN

you can whistle... while THEY work!

Here are a few furnaces that are now being used by many of the leading organizations in the foundry, die casting and permanent mold industries throughout this country of ours. They have done their respective jobs well! The fact is, when you install a Stroman Furnace for any non-ferrous metal melting job, you too, may sit back and "Whistle While They Work," for their efficiency, economy and longevity are your assurance of perfect pours, every time, at lowest costs.

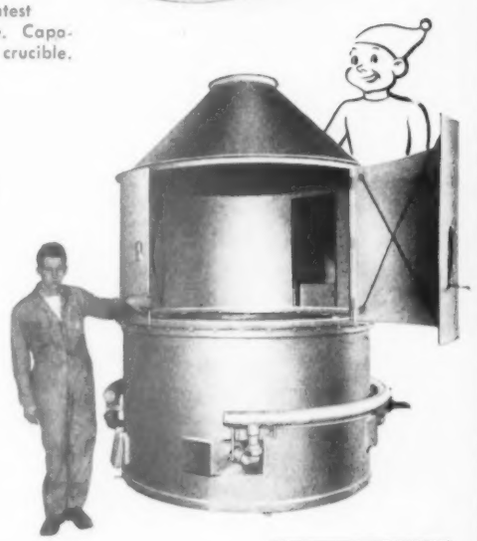


ECONOMELT FURNACES

The Best Direct Fired Reverberatory Melting Furnace on the market! Its speed in melting Brass, Bronze, Grey Iron or Aluminum is unmatched! Continuous charging . . . with cold metal never reaching the molten bath, makes it practically a continuous pour furnace . . . and it will show upwards of 40% in fuel cost savings. Oil or gas fire. Also can be furnished with combination oil, gas burner. Capacities (Brass) up to 2000 lbs. Write for Bulletin No. 635 for full information.

STROMAN CRUCIBLE STATIONARY MELTING FURNACES

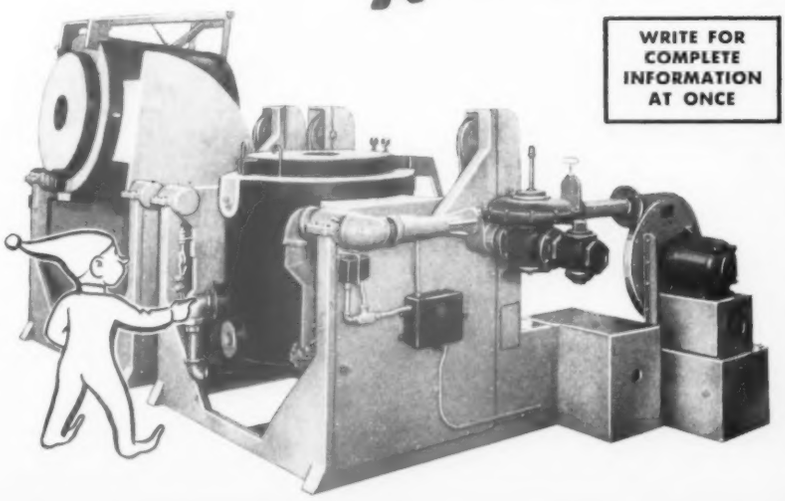
For Brass, Bronze, Aluminum and other non-ferrous metals. Sturdy, efficient and featuring the Stroman Push-Back Cover these stationary furnaces are designed for peak production and greatest fuel economy. Oil or Gas Fire. Capacities from No. 20 to No. 400 crucible.



STROMAN IRON POT STATIONARY MELTING FURNACES

These furnaces are highly recommended as break down furnaces for zinc die casting plants. They also excel as aluminum holding furnaces. They can be supplied with or without hoods to exhaust fumes and heat. Their construction assures longest pot life and lowest fuel costs. Choice of manual or automatic controls and gas or oil fire. Capacities from 212 to 14,000 lbs. of zinc.

WRITE FOR COMPLETE INFORMATION AT ONCE



STROMAN MECHANICAL OR HYDRAULIC TILT CRUCIBLE MELTING FURNACES

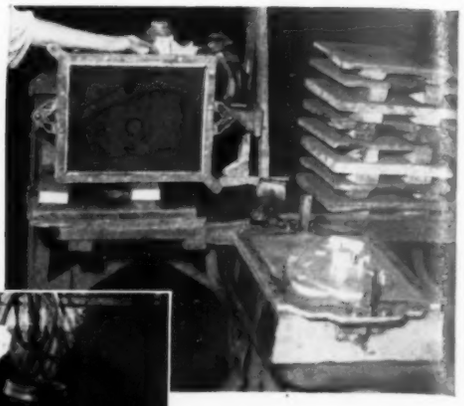
For Brass, Bronze, Aluminum and other non-ferrous metals. Stationary Lip Pour assures a constant pouring arc, eliminating the necessity of moving the ladle at any time during a pour. They are excellent for use in permanent mold and die casting plants as well as any foundry. Their sturdy construction assures longest life, and their economical operation results in lowest production costs. Oil or gas fire. Built in sizes to handle capacities from No. 125 to No. 400 crucible.

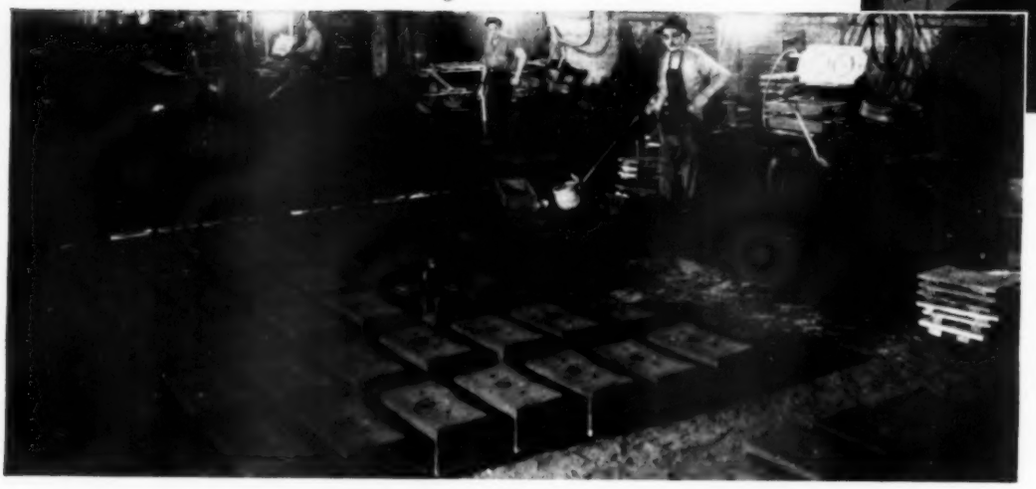
STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

NEW!



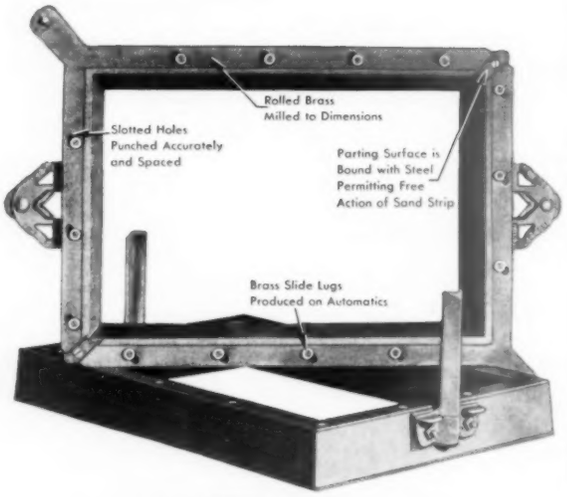


foundry flasks

with precision-made 100% machined sand strips . . . another advance by Diamond.

Write for bulletin "F" for complete details.

And note this: we can make prompt delivery!



DIAMOND

Telephone 2553 CLAMP AND FLASK COMPANY Richmond, Indiana

Designers of CORE PLATES, JACKETS, BANDS, FLASKS *since 1889*

SNAPPY ACTOR ...RAMS CORES FASTER

THIS new Rotor No. 22-B Sand Rammer in this foundry is blasting costs because it hard-packs core sand much faster than previous rammers. Its blows are fast and snappy.

Have you investigated the new Rotor Rammers for your work? There's a type for every job . . . light or heavy duty . . . bench or floor model. Write for a free copy of Bulletin No. 32.

AIR O'TOOL

GRINDERS

THE ROTOR TOOL CO.

RAMMERS

CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

A New Revolutionary Molding Machine

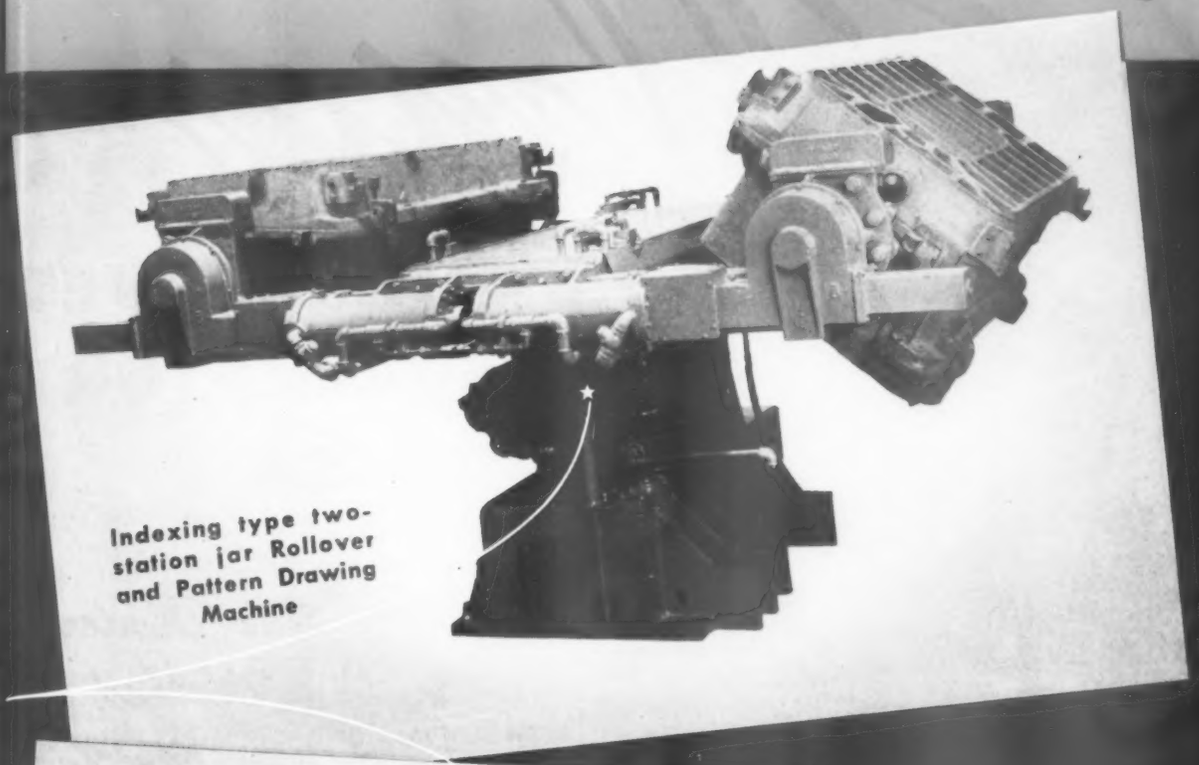
We are pleased to announce the development of a new indexing molding machine, the Herman Stationmaster, the result of five years continuing research.

The first installation of these machines reveals a high rate of production due to the basic principle of permitting required operations to be performed simultaneously rather than in sequence which is necessary with standard molding equipment.

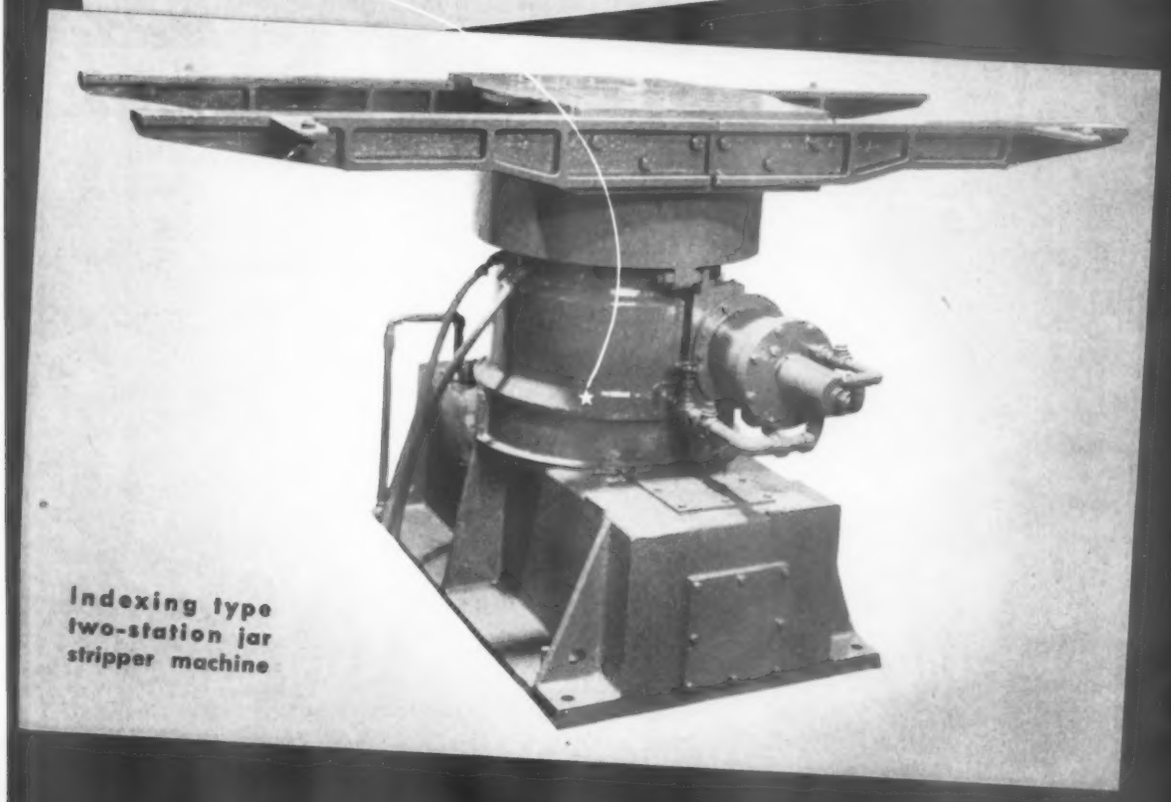
These machines are now in operation and have *doubled* the production of previous standard equipment in the plant of a prominent manufacturer.

***Fully Patented*

MOLDING HERMAN MACHINES



Indexing type two-station jar Rollover and Pattern Drawing Machine



Indexing type two-station jar stripper machine

MAN PNEUMATIC MACHINE CO. • UNION BANK BUILDING, PITTSBURGH, PA.

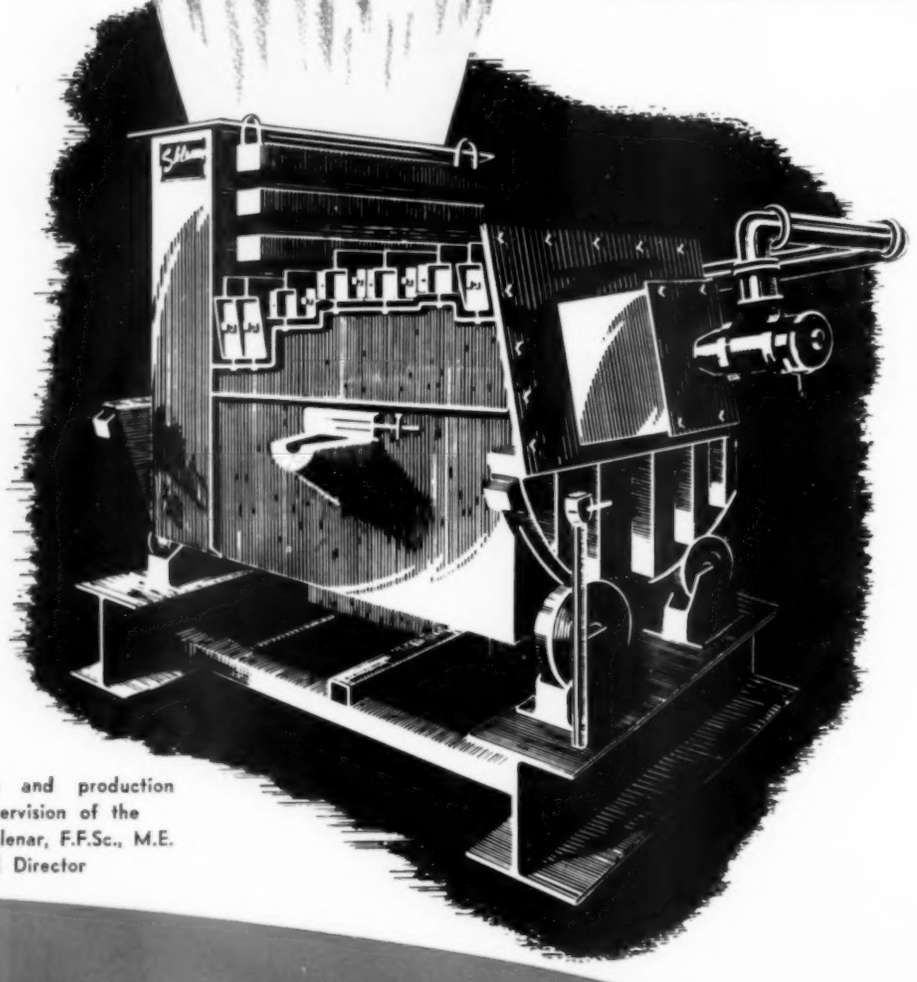
DETROIT PUBLIC LIBRARY

THE ORIGINAL

Sklenar

NEW IMPROVED REVERBERATORY FURNACES

The Modern Method of Melting Metals



All specifications and production under the supervision of the inventor, W. F. Sklenar, F.F.Sc., M.E. Technical Director

Patented, Patent Pending and Patents Applied for

SKLENAR FURNACE

A Subsidiary of W

38 MEMORIAL DRIVE

.... Maintenance Economy means

COMPARISON OF COSTS *
(RED BRASS)

	SKLENAR	COST	CRUCIBLE TILT	COST
Total weight melted	259,270 lbs.		259,270 lbs.	
Number of heats	432			
Total hours labor (maint.)	26	26.52	64	65.28
Number Crucibles used (#120)			8	176.00
Fire brick	78	15.60		
Cement used	100 lbs.	8.90	400 lbs.	35.60
Fire clay used	400 lbs.	12.00	600 lbs.	18.00
Total hours labor daily for preparation	None		172 hrs.	175.44
Time of heats for melt	17 min. (600 lbs.)		40-50 min. (360 lbs)	
Total Maintenance Cost		$63.02		$470.32

* The figures in the chart above are taken from the cost records on maintenance for a six months period, by a manufacturer operating the Sklenar Furnace #600-750 size and also the crucible tilting type furnace. Name of manufacturer gladly furnished on request.

GREATER PROFITS

Alert foundrymen find the NEW IMPROVED SKLENAR REVERBERATORY FURNACE a boon in reducing melting costs . . . in increasing production of superior metals. The SKLENAR is the ONLY furnace that gives perfect combustion . . . perfect atmosphere control. Maintenance costs minimized; producible tonnage maximized. Write for our descriptive circular F-1 for complete details and specifications.

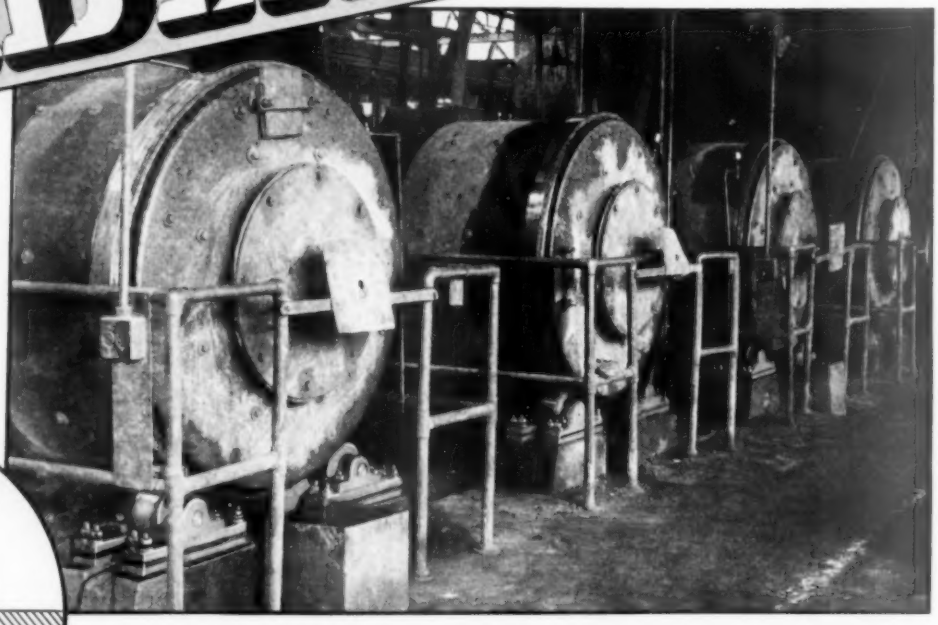
AND MANUFACTURING CO., INC.

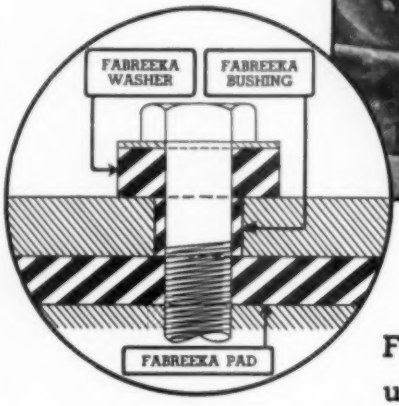
WILSON INDUSTRIES, INC.

CAMBRIDGE, 42, MASS.

Under Tumbling Barrels

FABREEKA





SHOWN ABOVE
CROSS SECTION OF FABREEKA INSTALLATION

REDUCES DESTRUCTIVE EFFECTS OF HEAVY IMPACT SHOCKS AND VIBRATION...

FABREEKA Pads, bushings, and washers are installed under Shakeout Machines, Jolt Moulders, Tumbling Barrels and other heavy machinery to reduce the effects of heavy impact shocks and destructive vibration.

FABREEKA has demonstrated its ability to prevent breakage of machine parts and to keep bolts tight, thereby reducing maintenance and increasing production.

In addition to these important advantages, Fabreeka has long life, which makes its final cost a low cost.

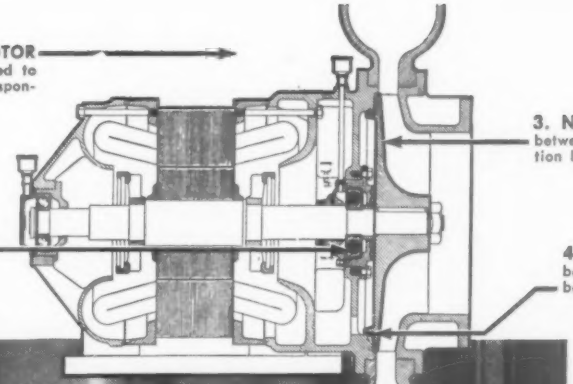
Write for latest literature

It Pays To Specify Fabreeka

FABREEKA PRODUCTS COMPANY, INCORPORATED
222B Summer Street
Boston 10, Mass.

for IMPACT SHOCK and VIBRATION

Specify Allis-Chalmers Cupola Blowers - *IT PAYS!*

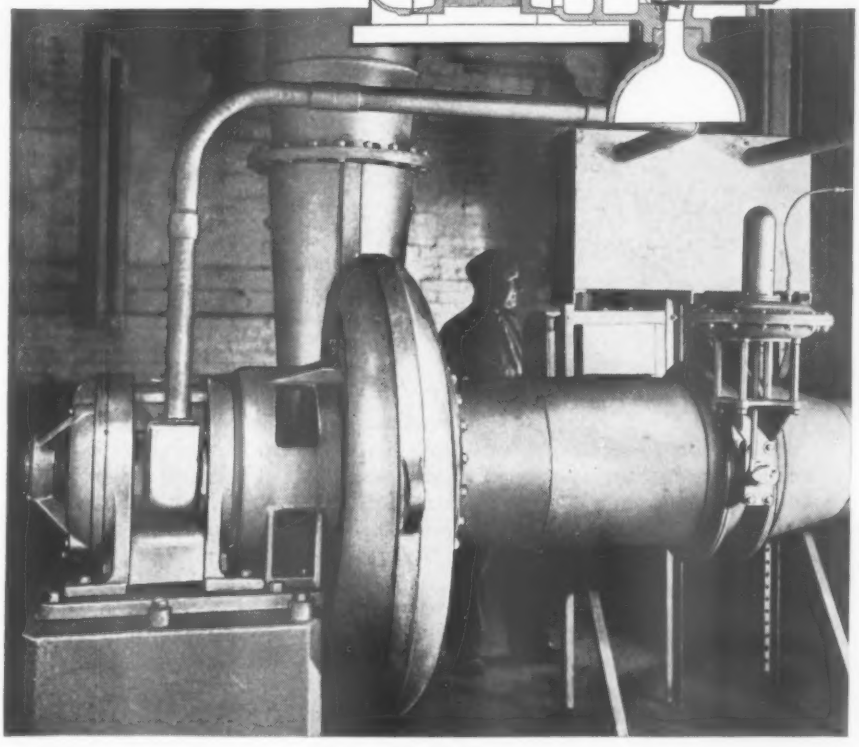


1. BOTH BLOWER AND MOTOR built by Allis-Chalmers, designed to operate together . . . entire responsibility rests in one company.

2. SIMPLE, COMPACT . . . only one moving part, the impeller which is mounted directly on the motor shaft.

3. NO METAL TO METAL CONTACT between moving parts. Heavy, anti-friction bearings are the only wearing parts.

4. SEAL RING ON IMPELLER balances end thrust . . . reduces bearing loads to a minimum.



Foundrymen, Consultants:

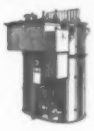
ONE OF THE BIGGEST FACTORS in overall cupola operating economy is the blower. That's why it's just sound business to have all the facts about all types of blowers before you go ahead.

For example: The design of *Allis-Chalmers* cupola blowers stems from over *60 continuous years* building high speed rotating equipment. Hundreds have been installed, and the very first units are still operating. Users say A-C blowers are easy to maintain . . . low in operating cost . . . that they have unusually long life.

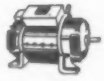
So compare *before* you buy, prove to yourself that "it pays to specify 'Allis-Chalmers'." ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2293

A-C BUILDS BASIC MACHINES, BLOWERS, PUMPS, DRIVES, ELECTRICAL EQUIPMENT FOR FOUNDRIES

ARC FURNACE transformers in any size for any furnace application. Five separate tap positions and a change from Delta to Wye connection give a wide range of voltages.



REGULEX* CONTROL for arc furnaces lowers and raises electrodes in response to rapidly changing conditions of the furnace charge. It makes possible lower cost melts, reduces electrode breakage.



COMPLETE LINE of motor controls for every requirement of motor operation. Manual or magnetic, reversing and non reversing, across the line or reduced voltage, single or multi-speed.

SEND FOR BULLETIN 07B6092A, "Foundry Mechanization"— It's packed with helpful, usable information on the *entire* Allis-Chalmers line of heavy foundry equipment.

*Allis-Chalmers Trademark

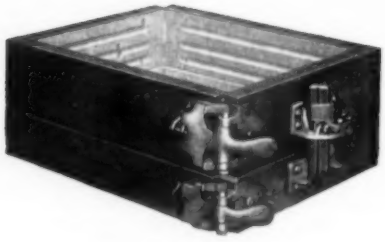
ALLIS·CHALMERS

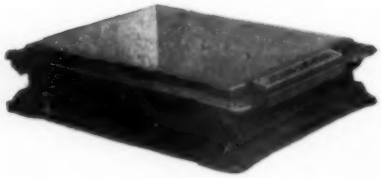
One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

A CENTURY OF SERVICE to Industry THAT MADE America Great

THE WINNING COMBINATION

Adams 12"-38"
Jolt Squeezer
Portable Type





ADAMS UNIVERSAL JOLT SQUEEZERS

EQUALLY efficient as jolt-squeeze-pattern-draw machines or plain jolt squeezers, these simply designed production units will reduce production costs and minimize rejects. Their operation is so simple and easy that no special skill is required to maintain uninterrupted high production levels. Available in both post and side rod types, stationary and portable.

ADAMS CUSTOM-BUILT FLASK EQUIPMENT

When you use Adams Flask Equipment you are assured the superior performance that means peak production. Adams Cherry Slip Flasks or Cherry Snap Flasks used with Adams Cast Iron, Aluminum or Steel Jackets are a combination hard to beat for accuracy, convenience and economy. Remember—all Adams Flask Equipment is made by experienced craftsmen to your exact specifications.

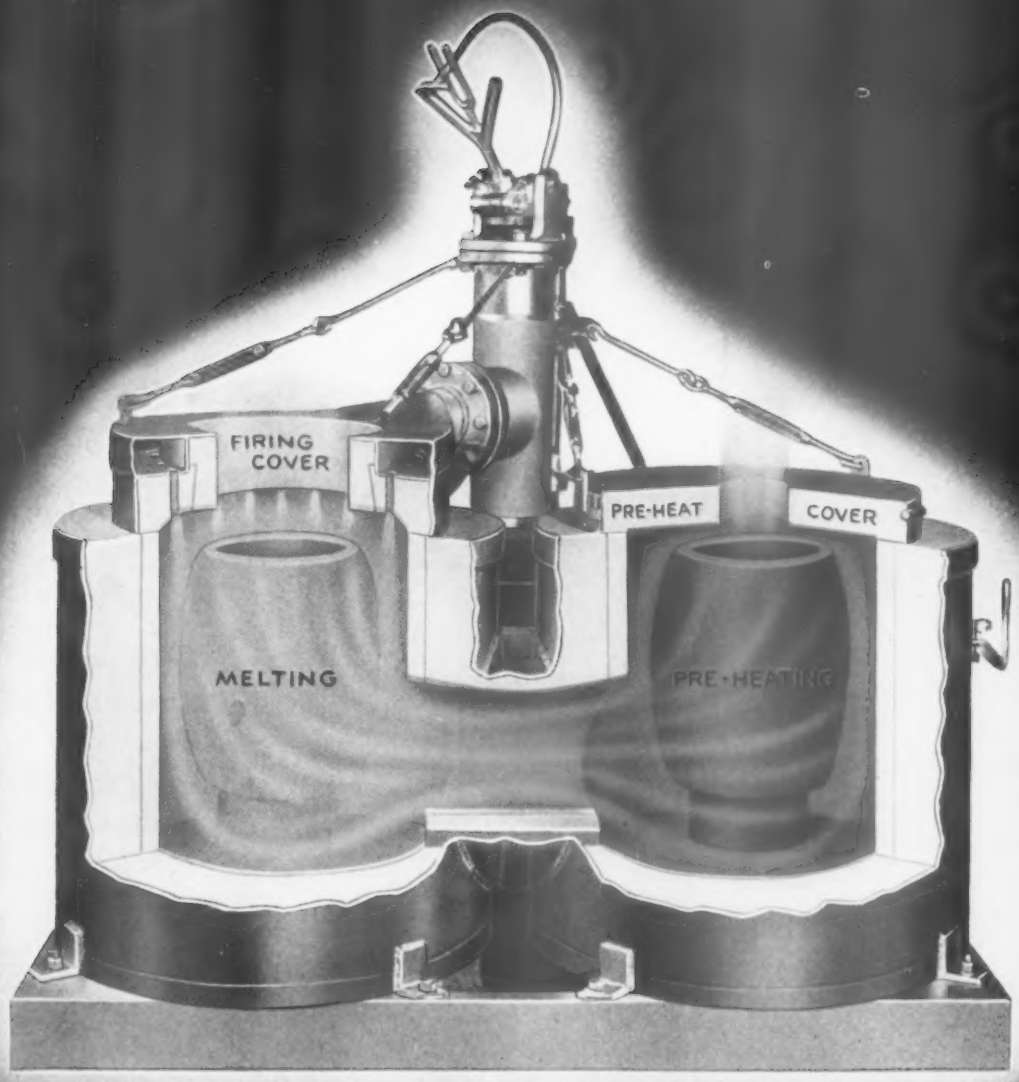
WRITE FOR descriptive literature detailing the production-boosting features of Adams foundry equipment line. THE ADAMS COMPANY, 800 Foster St., Dubuque, Iowa.

The ADAMS Company

ESTABLISHED 1883

DUBUQUE, IOWA, U.S.A.

MOLDING MACHINES and FLASK EQUIPMENT



Randall TWIN FURNACE

MORE HEATS . . . FASTER . . . AT LESS COST!

● The Randall-Twin Furnace reduces melting costs and melting time so much that you will find it hard to believe it until you see it!

The reason is clearly shown above. While you melt one pot, you pre-heat a second. Not only does that eliminate starting each melt with a cold pot (saving time) but it gives double use of the burner heat (saving cost).

There is nothing like it anywhere and we would like to tell you more about it. Write for our new circular or ask for our representative to call.

THE RANDALL CORE BLOWER PRODUCES BETTER CORES—FASTER

Randall TWIN FURNACE will save you money

THE RANDALL FOUNDRY EQUIPMENT CORPORATION

4600 EAST 71st STREET • CLEVELAND 5, OHIO

IMPROVED
HEAVY-DUTY
MOLDING MACHINES
Jolt . . Squeeze and Pattern Draw

ACCEPTANCE

The international acceptance of large numbers of NICHOLLS Molding Machines for many years is evidence of their productive capacity combined with low upkeep and reliability. NICHOLLS design and construction is the basis of this reputation.

PRECISION BUILT

Pistons and Cylinders are finished ground to micrometer sizes. All draw pins and guide bushings are case hardened and ground to precision tolerances for perfect fit and smooth operation.

11-32 Type "D"
Shown with Parallel Self-Positioning Squeeze Head

AUTOMATIC CONTROLS

These machines can be equipped with Push Button Control for all operations, including jolt and squeeze timing.

ALIGNMENT

The one piece heavy base and cylinder castings with integral supports for uprights, guide pins, bushings and valve brackets assures rigidity and permanent alignment.

LOW UPKEEP

For satisfactory performance over extended periods, dirt proof housings and forced lubrication have been provided for all parts that might otherwise wear quickly; thereby assuring low upkeep costs.

Wm. H. NICHOLLS Co., Inc.
RICHMOND HILL 18, LONG ISLAND, NEW YORK

ESTABLISHED 1910

Foreign Manufacturers and Selling Agents—
For Continental Europe and Great Britain—George Fischer, Ltd., Schaffhausen, Switzerland.

NICHOLLS

Sterling FLASKS Go a Long Way!

Single Shipment of 3000 Sterlings for Large Foundry in Brazil, S. A.

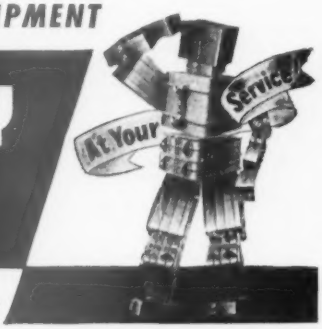
The illustration above shows part of a shipment of 3000 Sterling Steel Flasks destined for a large foundry in Brazil, South America. Foundries in the United States, Canada, and in many foreign countries look to Sterling for their flask requirements. Sterling Flasks are specified because they have the strength to resist distortion and to take hard, everyday punishment under the most adverse conditions. All-steel, all-welded, Sterling Flasks are fabricated into one solid piece, capable of withstanding tremendous pressures and retaining their rigidity and accuracy under severe production schedules. Get the facts. Write for your copy of Sterling Catalog No. 59, just off the press.

STERLING STYLE "A" FLASK

Fabricated from Sterling special rolled steel channel. Equipped with double pin lugs. Sections can be stacked or built up for multiple molding.

MORE THAN 4000 FOUNDRIES USE STERLING FOUNDRY EQUIPMENT

Sterling FOUNDRY FLASKS



STERLING WHEELBARROW COMPANY • Milwaukee 14, Wis., U.S.A.

Recommended
FOR YOUR
PATTERN SHOP OR FOUNDRY

THE FREEMAN SUPPLY COMPANY IS PLEASED TO OFFER THE EQUIPMENT SHOWN HERE AS WELL AS OTHER MODERN EQUIPMENT.

Pattern Makers Mill

Prompt Deliveries

•

PRICE AND DELIVERY INFORMATION SENT UPON REQUEST

20" Band Saw

Supply Headquarters

FREEMAN ALSO OFFERS FOR IMMEDIATE SHIPMENT FROM STOCK:

- Leather Fillet—Wax Fillet—Wood Fillet
- Glass Shellac Pots—Flake or Prepared Shellac
- Core Vents—Slotted, Screen or Perforated Type
- Pattern Letters—White Metal, Brass and Aluminum
- Bead Glue (Hot)—Plastic Resin Glue (Cold)
- Sta-Warm Automatic Electric Glue Pots
- Freeman Core Files (Abrasive Type)

COMPLETE INFORMATION ON REQUEST

FREEMAN *Dowmetal* PLATES

Pattern Plate

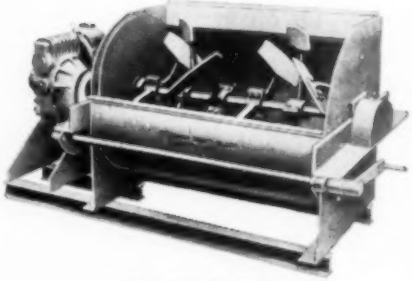
Spindle Sander

Disc Sander

THE FREEMAN SUPPLY COMPANY
1152 E. Broadway Toledo 5, Ohio

18" and 24" Planer

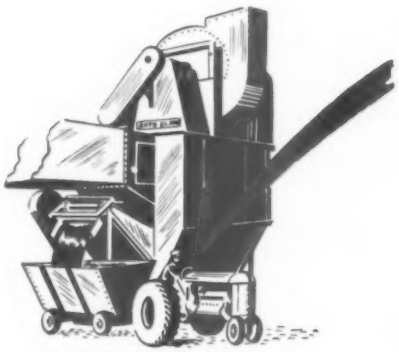
Core & Mold Sprayer



Multi-Blade Mixer

There's no secondary dust problem with a Roto-Clone

NOT THIS



BUT THIS

**Roto-Clone is the trade-mark (Reg. U.S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.*

Wet type collection eliminates rehandling and disposal of dry dust

DUST control doesn't end with just the collection of the material. There's the problem of disposal. And that's where Roto-Clone* goes one step farther to do a *complete* job of dust control.

AAF Type W and Type N Roto-Clones are both high efficiency wet type collectors. In both units the collected material is discharged as a slurry or sludge. Method of disposal can be varied to meet your requirements.

Either the Type W or Type N Roto-Clone can be supplied in three arrangements, permitting disposal of sludge by (1) continuous direct discharge to process, settling tanks, disposal tract or sewer, (2) manual removal from storage hopper, or (3) automatic removal from storage hopper by mechanical conveyor.

If you want to control dust completely, both at its source and point of collection, you will want to investigate the Type W and Type N Roto-Clones. Each covers a wide range of applications and both solve the problem of secondary dust control. For complete information, call your local AAF representative or write direct to—

AMERICAN AIR FILTER CO., INC.
266 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

MEMBER MANUFACTURERS ASSOCIATION INC. FOUNDRY EQUIPMENT

AAF

ROTO-CLONE®
DUST CONTROL EQUIPMENT

The **DALLETT LINE** *of Pneumatic Tools and Accessories*

Precision Built

Valve Type

Dallett Valveless

Chipping Hammer

Write for Pneumatic Tool Bulletin No. F100

Valveless

Safety Retainer Chipping Hammer

Scaling Hammer

Write for Pneumatic Chisel Bulletin No. F200

Dallett Pneumatic Tools are made in a number of sizes and designs for many specific uses . . . valve and valveless type, with button, lever or handle control:

Interchangeable

"Dalbo" Hose Ends

Dallett's—"Dalbo"—Air Hose Fittings and Couplings are machined from solid bar stock—are leak-proof—with safety locking sleeve.

Forged Tools

"Dalbo" Interchangeable Pipe Ends

Write for Forged Tool Bulletin No. F210

"Dalbo" Couplings

Dallett chisels and blanks are made in most standard shanks—safety retainer chisels are available for most makes of small pneumatic tools.

"Dalbo" Pneumatic Fittings

Write for "Dalbo" Couplings and Fittings Bulletin No. F300

Safety Retainer Chisels

TOOL MAKERS PNEUMATIC DALLETT EQUIPMENT ACCESSORIES SINCE 1883

THE DALLETT COMPANY

MASCHER AT LIPPINCOTT STREET, PHILADELPHIA 33, PA.

Manufacturers of Pneumatic Tools and Accessories

DISTRIBUTORS in principal cities throughout the United States, Canada, Europe and South America.

ROSSBOROUGH

Nonferrous Fluxes

BRASS AND BRONZE FLUX—A neutral flux with low melting point which protects your metal during the melting process and keeps furnace and crucibles clean without attacking the linings.

ALUMINUM FLUX—An all purpose aluminum flux designed to deoxidize, de-gas and increase recovery from skimmings at a lower temperature.

ALUMINUM BOILING FLUX—A special aluminum flux for preventing shrinks and misruns in permanent mold and thin section sand castings.

ALUMINUM SMELTING FLUX—A powerful flux for use on all scrap materials. Reacts at a low temperature increasing metal recovery. Recommended for smelting use or for remelting of gates, borings and scrap.

Completely Stocked Jobbers

BOSTON, MASS.—Malcolm G. Stevens
CHATTANOOGA, TENN.—Manufacturers Equipment & Supply
CHICAGO, ILL.—Foundry Supplies Company
CLEVELAND, OHIO—Hoffman Foundry Supply
DAYTON, OHIO—Fenton Foundry Supply
DETROIT, MICH.—Wolverine Foundry Supply
INDIANAPOLIS, IND.—J. M. Glass Company
NEW YORK, N. Y.—New York Sand & Facing
PHILADELPHIA, PA.—George F. Pettinos, Inc.
ST. LOUIS, MO.—M. W. Warren Coke Company
LOS ANGELES, CALIF.—Independent Foundry Supply Company

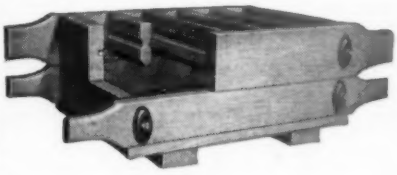
Specialists in Nonferrous Fluxes for 16 Years

ROSSBOROUGH SUPPLY COMPANY

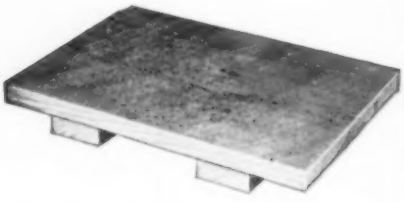
1457 West Ninth St., Cleveland, Ohio

CMD FOUNDRY SPECIALTIES

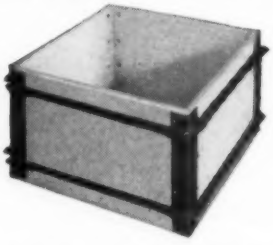
WEDGES
Hard or soft wood



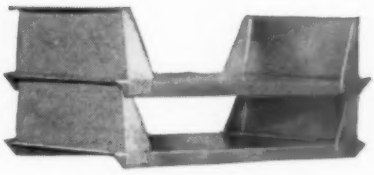
CMD WOOD FLOOR FLASKS
All sizes and shapes



CMD WOOD BOTTOM BOARDS
All sizes and shapes



CMD NON-WARP, NON-BURN SLIP JACKETS



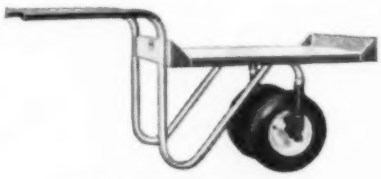
CMD DUAL-PURPOSE CORE TRAYS

CMD TYPE F CHIPPING HAMMER
Metal handle. Head has 2 chisels at right angles

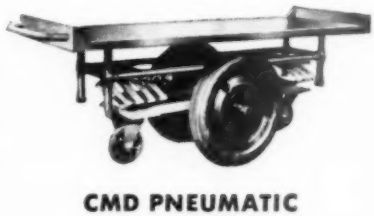
CMD TYPE A CHIPPING HAMMER
Combination drift and chisel

CMD TYPE C CHIPPING HAMMER
For general hand chipping

TEXTITE AIR SEPARATOR
Cools, cleans and dries the air in one operation. *No moving parts.* Saves air tools. Nothing to replace.



CMD PNEUMATIC CORE BARROWS
With single wheel or two wheels. (as shown here)



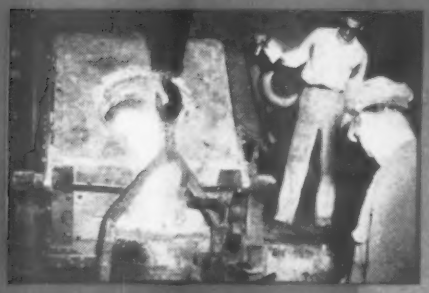
CMD PNEUMATIC CORE TRUCKS
Minimize core chafing and breakage

WRITE FOR BULLETINS
On CMD core-conveying equipment and other foundry specialties—preferred by experienced foundrymen for 25 years.

CHICAGO MANUFACTURING & DISTRIBUTING COMPANY

1928 WEST 46th STREET CHICAGO 9, ILLINOIS

HANDLING HEAT *with* NORTON REFRACTORIES

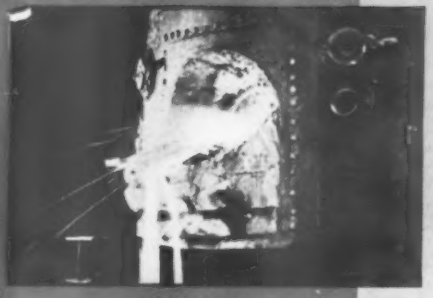


HIGH TEMPERATURE CEMENTS

Norton refractory cements (and pre-fired shapes) give many more melts than the average furnace lining and a variety of mixtures are available for melting aluminum, stainless steel, copper alloys, and nickel-chromium, nickel-silver, copper-nickel and cadmium bronze alloys.

TUBES, CORES AND MUFFLES

For heat-treating and sintering metals—and particularly for drawing and swaging tungsten and molybdenum wire and sintering cemented carbide tools—Norton Company supplies a complete variety of refractory tubes, cores and muffles in aluminum oxide and silicon carbide.



SLAG HOLE BLOCKS

Made of densely bonded silicon carbide these blocks resist both the abrasion and penetration of molten slag. They are chemically inert to all slag action either by corrosion or erosion. The hole size is maintained for a long period of trouble-free service.

HEARTHS AND FURNACE SHAPES

Silicon carbide hearth plates, muffles and other shapes assure long lining life and low fuel costs in heat-treating furnaces of many types. High refractoriness, great strength, high heat conductivity and resistance to spalling and abrasion are important qualities of these refractories.

OTHER NORTON REFRACTORIES

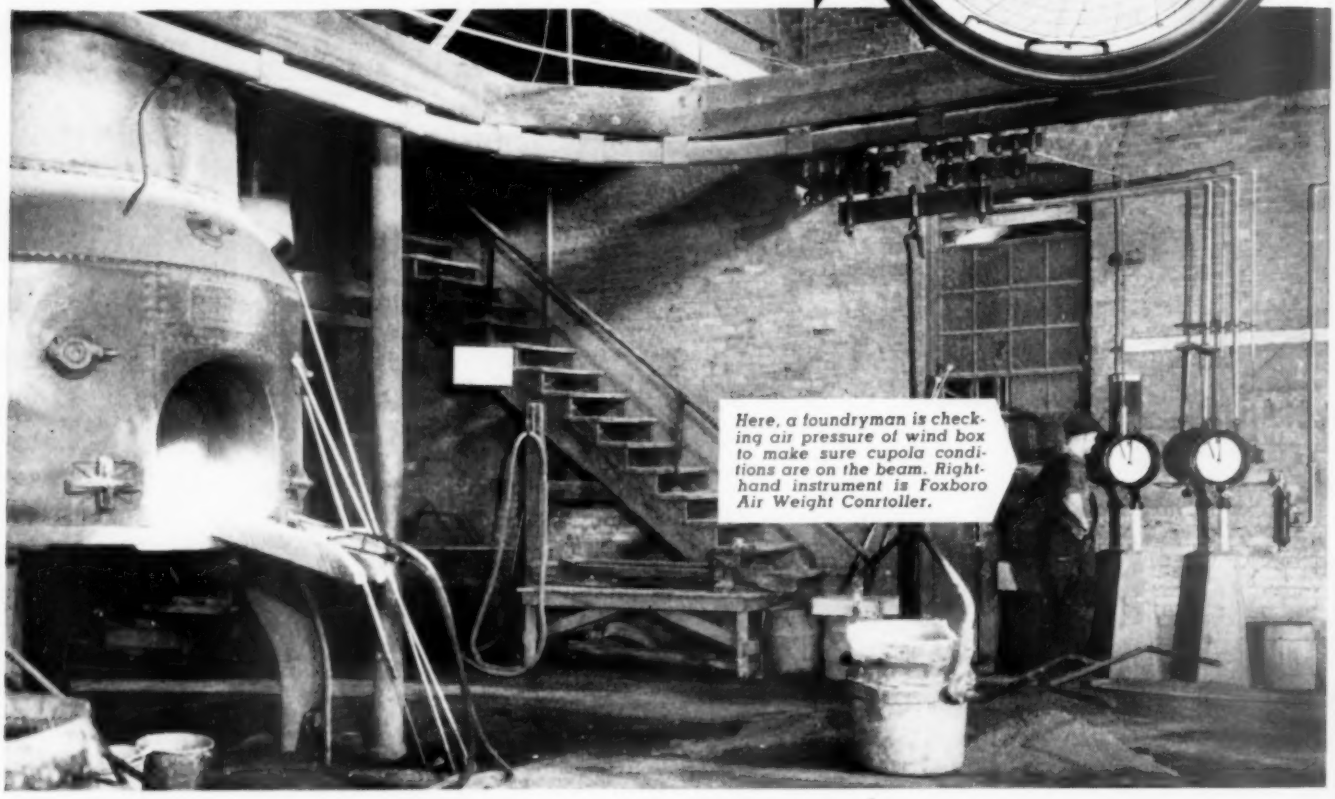
For handling high temperature operations Norton Company also manufactures: silicon carbide bricks for boiler furnaces and gas generators, muffle and bottom plates for enameling furnaces, muffles and furniture for ceramic kilns, burner blocks and burner tunnel cements, porous mediums for commercial use, laboratory ware.

NORTON REFRACTORIES LIKE HEAT

NORTON COMPANY
WORCESTER 6, MASS., U. S. A.

Keep the "BUGS" out of cupola operation

with this Trouble Spotter



Here, a foundryman is checking air pressure of wind box to make sure cupola conditions are on the beam. Right-hand instrument is Foxboro Air Weight Conrtoller.

FOXBORO WIND BOX PRESSURE RECORDER

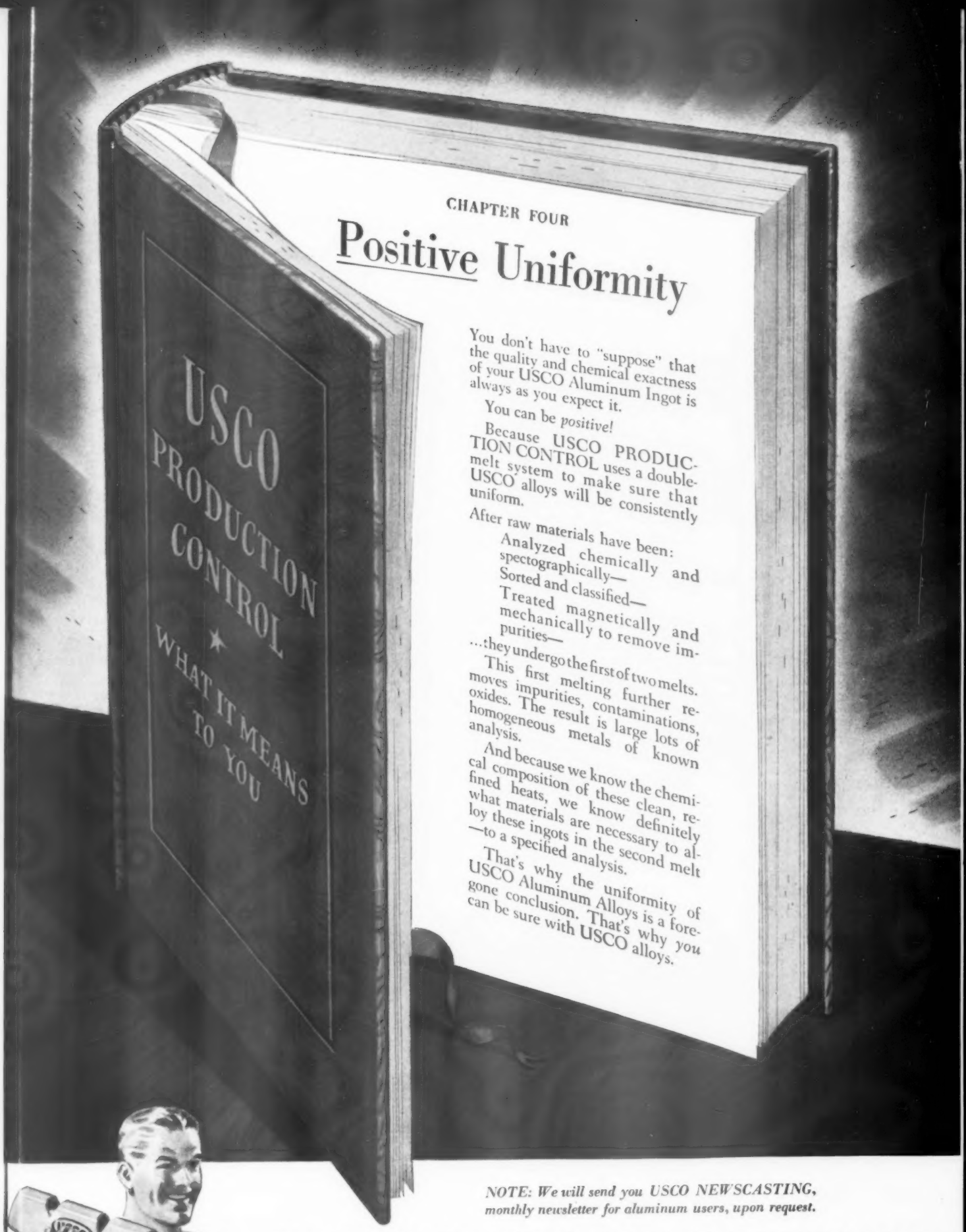
● Here's a simple, inexpensive installation that gives you written "advance notice" of adverse conditions in time to correct them before the cupola can go haywire. A Foxboro Pressure Recorder on the wind box keeps accurate records that show up trouble-making conditions such as bridging, clogging of tuyeres, effects of changes in size of scrap charge, and whether or not the charging rate is being maintained. In addition, the same records provide useful information for analyzing the causes of production variation.

This compact pressure recorder is widely used throughout all processing industries. Its dependable accuracy and trouble-free performance have stepped up the efficiency of many a process. When combined with the exclusive Foxboro Air Weight Controller, it produces outstanding improvement in cupola operation.

Investigate the cost-saving, time-saving advantages of Wind Box Pressure Recorders. A Foxboro Engineer will be glad to make recommendations to fit your specific needs. Write **The Foxboro Company, 32 Neponset Avenue, Foxboro, Mass., U. S. A.**

FOXBORO
REG. U. S. PAT. OFF.

RECORDING · CONTROLLING · INDICATING INSTRUMENTS



CHAPTER FOUR

Positive Uniformity

You don't have to "suppose" that the quality and chemical exactness of your USCO Aluminum Ingot is always as you expect it.

You can be *positive!*

Because USCO PRODUCTION CONTROL uses a double-melt system to make sure that USCO alloys will be consistently uniform.

After raw materials have been:

Analyzed chemically and spectographically—

Sorted and classified—

Treated magnetically and mechanically to remove impurities—

...they undergo the first of two melts.

This first melting further removes impurities, contaminations, oxides. The result is large lots of homogeneous metals of known analysis.

And because we know the chemical composition of these clean, refined heats, we know definitely what materials are necessary to alloy these ingots in the second melt —to a specified analysis.

That's why the uniformity of USCO Aluminum Alloys is a foregone conclusion. That's why *you* can be sure with USCO alloys.

NOTE: We will send you USCO NEWSCASTING, monthly newsletter for aluminum users, upon request.

USCO ALUMINUM

Pioneer Producers of Quality Aluminum Ingot

U. S. REDUCTION CO. *East Chicago, Ind.*

FERROCARBO Briquettes

THE NEW DEVELOPMENT in duplex malleable iron melting that provides these advantages:

1. Thorough deoxidation.
2. Prolonged increase in fluidity.
3. Less tendency for internal shrinkage.
4. Elimination of shrinkage cracks and hot tears close to or at point where risers feed castings.
5. Less breakage of castings during "shake-out." This results from reduction of massive primary carbides with their marked planes of weakness.
6. A finer, tougher carbide structure on annealing with evenly dispersed graphite nodules is provided in shorter time.

Actual plant records attest the economies effected by FERROCARBO Briquettes in malleable melting operations. Their possibilities in your plant should not be overlooked. Call in our metallurgical staff for complete information.

FERROCARBO Briquettes

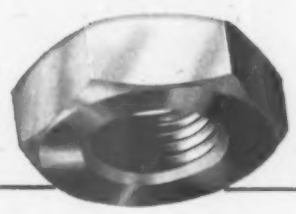
BY CARBORUNDUM
TRADE MARK

THE CARBORUNDUM COMPANY, Abrasive Grain and FERROCARBO Division, Niagara Falls, New York

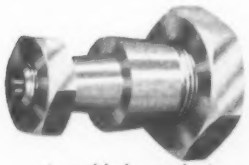
FERROCARBO Distributors: Kerchner, Marshall & Co., Pittsburgh, Cleveland and Birmingham; Miller and Company, Chicago, St. Louis and Cincinnati

"Carborundum" and "Ferrocarbo" are registered trademarks which indicate manufacture by The Carborundum Company

Get perfect Cope and Drag register — better castings — with UNIVERSAL FLASK PINS and BUSHINGS



Only when cope and drag are perfectly lined up do you get the perfectly formed sand molds necessary to turn out true castings—and you can depend on perfect register of cope and drag once you accurately install Universal Standardized Flask Pins and Bushings. These modern accessories to good foundry practice are precision made, hardened, and ground for lasting accuracy. They anchor firmly with self-locking nuts to provide the positive stability vital to true register. Universal Standardized Flask Pins and Bushings are available for immediate delivery in several sizes of round, elongated, press fit and other standard types for use in cast iron, steel, and aluminum flasks. The pins and bushings illustrated are primarily for use in aluminum or magnesium flasks. Special types and sizes made to order. Write for complete information, and give us particulars of your requirements so we may make specific recommendations.

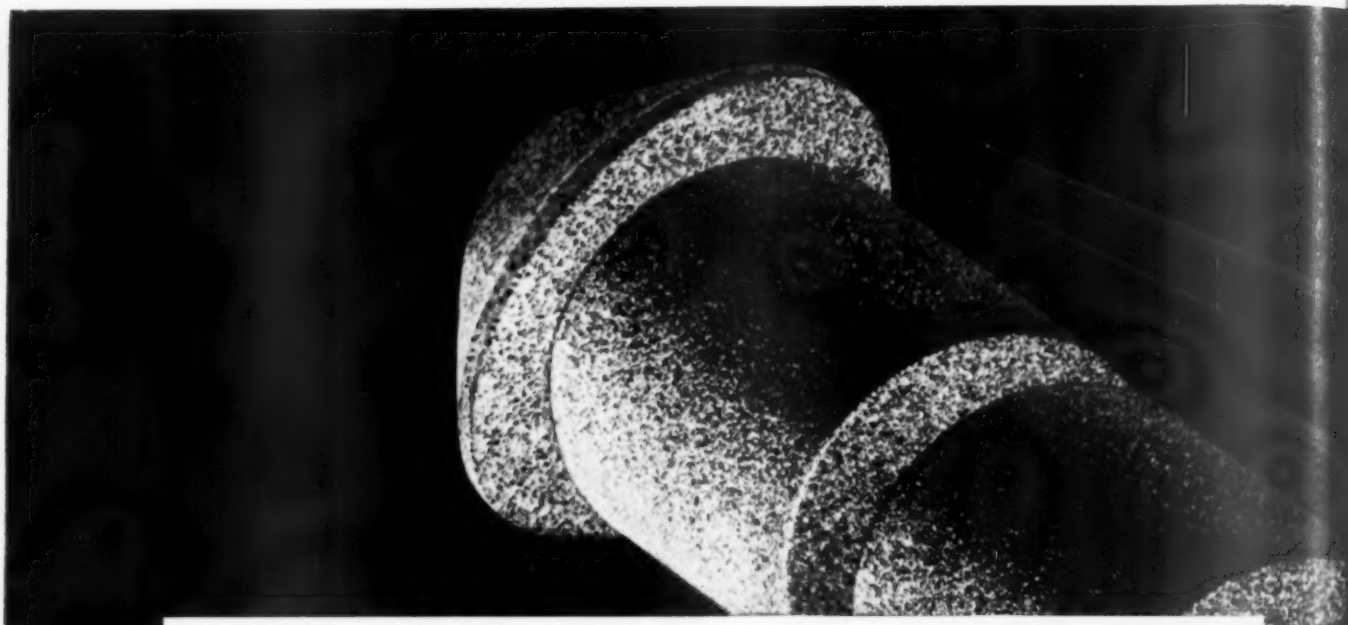


Assembled round pin and bushing.

Assembled octagon pin and elongated bushing.

Explosion view of octagon pin and elongated bushing.

UNIVERSAL ENGINEERING COMPANY • FRANKENMUTH, MICHIGAN



Is your cost-of-grinding going up?

Are your wheel-replacement costs, dressing costs and other grinding expenses climbing like a skyrocket—

While wheel-life, stock-removal and profits are coming *down?*

Make sure that your grinding isn't costing you more than it should. Call in a Peninsular engineer!

Your grinding—your methods, machines and materials—will be examined thoroughly, without obligation. Peninsular engineers will analyze their complete findings carefully, in the light of nearly sixty years of grinding experience.

Their suggestions will be based upon a thorough knowledge of your grinding problems, and the grinding wheels Peninsular engineers recommend to you will be individually engineered to your grinding jobs.

Call in a Peninsular engineer. It will mean lowered costs, higher production, bigger profits—we'll stake our reputation on it!

The Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7. *Sales Offices:* Chicago, Philadelphia, Buffalo, Cleveland, Pittsburgh, Houston, St. Louis, Cincinnati.

PENINSULAR

INDIVIDUALLY PENINSULAR *ENGINEERED*

GRINDING WHEELS

SINCE 1889

SPECIALISTS IN RESINOID BONDED WHEELS

The component parts of the two illustrations on these pages consist of photographs of various standard types and sizes of grinding wheels manufactured by Peninsular.

For the Foundry: **MOLD CONVEYORS • FLASK FILLERS • BUCKET ELEVATORS**
PADDLE MIXERS • SCREENS • BIN VALVES • CONVEYORS • AERATORS • SANDITIONERS

THE JEFFREY MANUFACTURING COMPANY

907-99 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 1	Buffalo 2	Cleveland 13	Harlan	Jacksonville	Pittsburgh 22
Birmingham 3	Chicago 1	Denver 2	Houston 5	Milwaukee	St. Louis 3
Boston 16	Cincinnati 2	Detroit 13	Huntington 19	New York 7	Salt Lake City 1
				Philadelphia 3	Scranton 3

If it's CAST IRON you can weld it with NI-ROD

WHAT NI-ROD GIVES YOU
—in performance
• Stable arc in all positions
• Smooth bead contour
• Excellent "wash"
• Easy slag removal
• Preheating seldom required
• Works on either a.c. or d.c.
—in Weld Quality
• High-strength deposit
• Easy machinability
• Thorough fusion
• Freedom from cracks and porosity
• Close color match

NI-ROD WELDING ELECTRODES SUCCESSFULLY BUILT UP THIS WORN DIE

Dished heads are just one of the products of Lukens Steel Company, Coatesville, Pa.

They're formed with large hemispherical dies. Dies made of cast iron. Dies that are fairly expensive. When one wears down, Lukens' maintenance men try to restore the original contours.

For several years Lukens had used brazing to build up the worn areas. Then they tried Ni-Rod* welding electrodes because of good reports on its strength and easy machinability.

Here's what Lukens has to say about this repair job:

> **"With other wires, it was found that welds would pull loose from the casting when in use. Ni-Rod was the only electrode that could be used successfully. It would not pull loose when in operation, and had a very good wearing quality. We now use Ni-Rod for building up dies to insure good wear and where pressure on the die is involved."**

The welded die (before machining) is shown at the left. Note the smooth layer of Ni-Rod beads. Proof of Ni-Rod's easy handling!

*Reg. U. S. Pat. Off.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

EMBLEM OF SERVICE
INCO NI-ROD

TRY NI-ROD AT OUR EXPENSE!

Prove to yourself that Ni-Rod has taken cast iron welding out of the "hit-or-miss" class.

Send in the coupon and get 3 free electrodes. Try 'em on any cast iron job you have. See if they're not the easiest-handling electrodes you ever used to weld cast iron.

Time and time again, Ni-Rod can save you money in repairing damaged iron castings; in building up worn areas; in correcting machining errors; on the production line to join cast iron to steel.

SEND IN COUPON TODAY ➡

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

Gentlemen: I'd like to try Ni-Rod welding electrodes. Please send me 3 free rods of the diameter I have checked.

☐ 3/32" ☐ 1/8" ☐ 5/32" ☐ 3/16"
(Please check *one* size only)

Name .....

Company .....

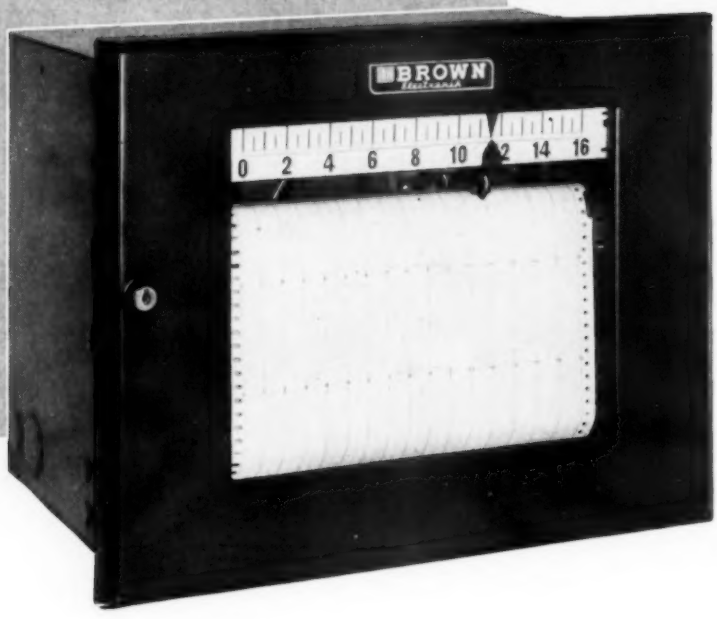
T.F. 7-48

Address .....

City ..... State .....

At last

Control Action comparable to "Continuous Balance" measurement



Both Electric *Contact* and *Proportioning* Control Now Available in Brown *ElectroniK* Potentiometers

A completely new electric control unit is introduced in the Brown ElectroniK Strip Chart Controller. At last, you can capture the full potential of "Continuous Balance" measurement directly in better electric control of your processes.

Available both in *contact* and *proportioning* models, it offers a degree of performance never before possible with electric control.

Contact control models now give "knife edge" sensitivity *plus* all the advantages of mercury switches—forever sealed in glass, permanently protected against dirt, dust, arcing effects and corrosive atmospheres. Absolute, perfect contacts are assured *every time.*

Proportioning control models achieve a new standard of precision for this form of control. Exact control values are produced by an electrically balance-tested resistor circuit.

Surely these electric control models are a fitting complement to the Brown ElectroniK Potentiometer line —for seven years the performance-proven leader in its field.

Additional information will gladly be mailed to you. Write for Catalog 15-13.

The Brown Instrument Co., 4420 Wayne Ave., Philadelphia 44, Pa.
DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.
Offices in principal cities of the United States, Canada and throughout the world.

BROWN *Advanced Instrumentation* **FOR BETTER PROCESSING**
Product of MINNEAPOLIS **Honeywell**

HERE'S HOW...

LINDBERG-Fisher 2-CHAMBER INDUCTION MELTING FURNACE DOUBLES ALUMINUM DIE CASTING PRODUCTION

Floyd J. Kamin, President, Kamin Die Casting & Manufacturing Co., says: "On this job our new Lindberg-Fisher Induction Melting Furnace turns out twice as much work as a conventional gas furnace with the same melting capacity, and rejects have decreased 65%—We operate continuously, and we find that melting cost is actually less than with a gas furnace of the same melting capacity."

Edmond L. Kornayzer, Plant Supt., says: "The furnace operates much cooler and operator fatigue is practically eliminated."

. . . Reduces Rejects 65% . . . Improves Working Conditions

Kamin Die Casting & Manufacturing Co., well known Chicago manufacturers of aluminum die cast products recently installed a 2-chamber Lindberg-Fisher Induction Melting Furnace. Here's a typical Kamin job —aluminum wheels used on Pincor lawnmowers. Check this "Before and After" story of increased production and reduction of rejects.

	BEFORE *—with conventional melting equipment*	AFTER *—with Lindberg-Fisher Melting Furnace*
Production Per Hour	25-30 Wheels	50-60 Wheels
Rejects Per 100	10-15 Wheels	3-5 Wheels

A few reasons why Kamin is well satisfied with this new Furnace

- Refractory lining holds molten metal, eliminates down-time to replace broken iron crucibles or pots.
- No contamination from iron pot or thermocouple.
- Continuous operation—when cold metal is added to charging chamber there is no temperature drop in ladling chamber.
- Operator does not have to push oxide coating to one side when ladling, as impurities remain in charging chamber.
- Super-sensitive thermocouple assures extremely accurate temperature control.
- Continuous electro-magnetic fluxing assures clean metal—prevents any possible segregation of alloys.
- Absolutely no worries about freeze-up because Lindberg-Fisher Furnaces can easily be started up after power failure.

Ask for Bulletin 510, "Lindberg-Fisher 2-Chamber Induction Furnaces for Melting and Holding"

Fisher Furnaces

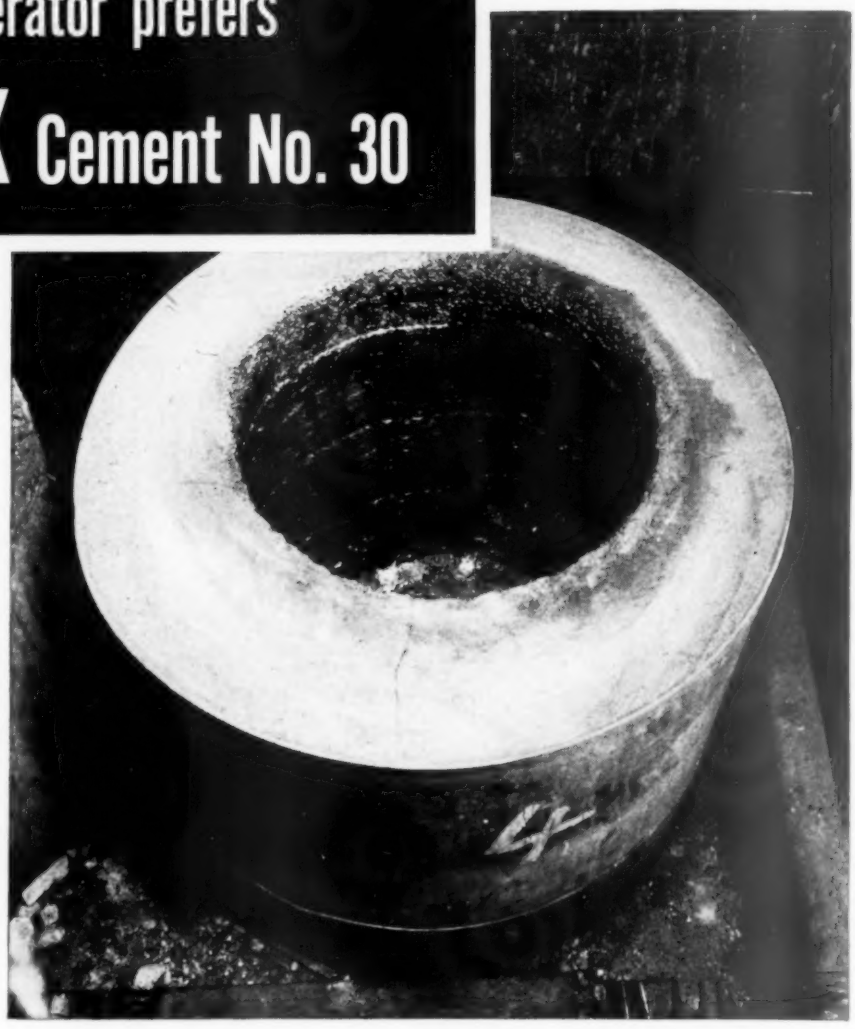
A DIVISION OF LINDBERG ENGINEERING CO.
2453 West Hubbard Street, Chicago 12, Illinois

3 REASONS WHY

Furnace Operator prefers

CARBOFRAX Cement No. 30

Oil Fired Crucible Furnace placed in operation Sept. 14, 1945. No maintenance to date. 3½" CARBOFRAX Cement No. 30 lining is backed up with 1" of refractory insulating splits and 1" of mineral wool batts.



1 LONGER SERVICE

2 LESS UPKEEP

3 RAMS BETTER

Because of reasons such as these, every crucible type melting furnace in this plant is now lined with CARBOFRAX silicon carbide cement No. 30.

Melting monel, nickel, S-monel, and inconel metals, furnaces are run eight hours daily, five days per week. Operating conditions are particularly tough. Incapable of withstanding them, ordinary refractory linings were replaced every six weeks. With CARBOFRAX linings an average life of 15 months service is secured with very limited patching. Maintenance expense is cut way down.

Easily worked, CARBOFRAX cement No. 30 rams into a hard, dense lining that does not soften. That's because of its high refractoriness. Flame erosion, too, is resisted successfully. Freedom from frequent patching is provided. With longer life from a CARBOFRAX lining, replacement is not required at short intervals.

Offering a lower lining cost per pound of metal melted, CARBOFRAX cement No. 30 is applied to both stationary and tilting furnaces. Check its possibilities for your work. Secure complete information by writing Dept. B-78, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

SUPER REFRACTORIES

BY CARBORUNDUM

TRADE MARK

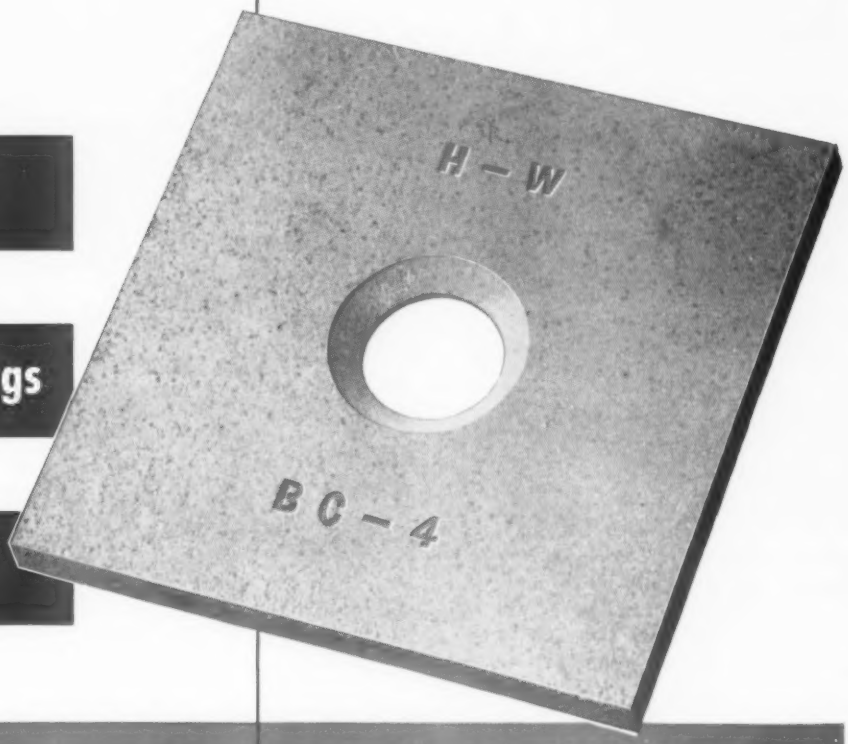
"Carborundum" and "Carbofrax" are registered trademarks which indicate manufacture by The Carborundum Company

H·W Refractory Breaker Core Shapes

reduce your costs

improve your castings

speed production



YOU can have necked-down risers without core boxes, patterns or baking, by using Harbison-Walker ready-made, refractory Breaker Core Shapes. Made of burned refractories, they contain no combustible or volatile materials. Thus, one source of troublesome core gas in the mould is eliminated.

The use of Harbison-Walker Breaker Core Shapes saves hours of time, produces cleaner castings, reduces labor. Various sizes are provided—to fit every foundry need. They produce a smooth, hard surface on the casting, and a necked-down area in the riser that permits its fast and easy removal.

The sizes you need

Harbison-Walker Breaker Core Shapes are available in ten sizes, for risers of 2 to 12 inches in diameter. These sizes were developed in cooperation with Technical Research Committee of the Steel Founders' Society of America. They are durable, and will withstand considerable rough handling. Packed in convenient cartons, ready for use. Readily stocked in all needed sizes. Write for bulletin giving complete data.

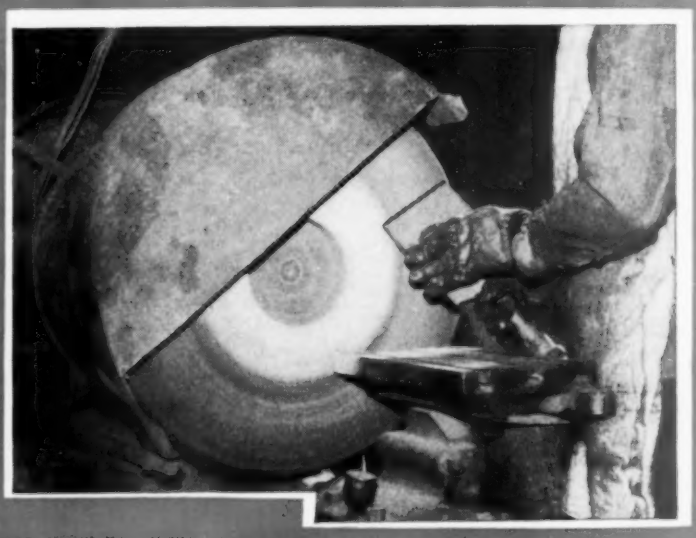
TRADE MARK
REG U S PAT OFF

Harbison·Walker
REFRACTORIES COMPANY *and Subsidiaries*
GENERAL OFFICES · PITTSBURGH 22, PA.

WORLD'S LARGEST PRODUCER OF REFRACTORIES

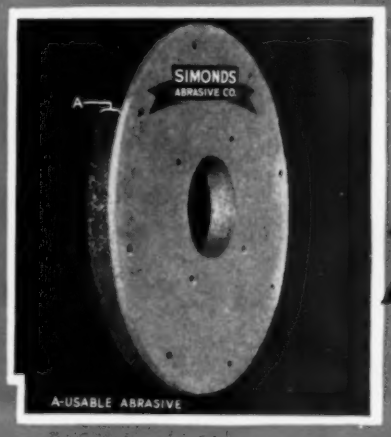
the grinding job

Grinding sides and edges of spades used on pneumatic hammers. This is offhand, dry grinding on a No. 4 Gardner Double End Horizontal Spindle Disc Grinder. The job requires satisfactory grinding action with maximum wheel life.



the wheel

Borolon resinoid bonded nut-inserted disc, A30-08-B1, size 23" x 2" x 6", adopted as standard for production work because of long wheel life. This application is typical of the successful use of Simonds Nut-Inserted Disc Wheels or Bolt-Inserted Cylinder Wheels for a wide variety of grinding jobs throughout many industries.



Borolon ALUMINUM OXIDE — *Electrolon* SILICON CARBIDE

SIMONDS ABRASIVE CO.

PHILADELPHIA, PA.

Grinding Wheels

Every size and shape for every grinding job . . . centerless, crankshaft, cut-off, cylindrical, internal, knife grinding, mounted points, portables, roll grinding, saw gumming, snagging, surfacing (wheels and segments), tool and cutter, bricks, sticks, stones and abrasive grain for polishing, pressure blasting, anti-slip, etc.

where to get it

From your Simonds Abrasive Co. Distributor located in all key industrial centers here and in many foreign countries. He stocks Simonds Grinding Wheels for every grinding job and can advise on grinding wheel selection. Write for name and address of distributor serving your area. For specific grinding wheel recommendations give brief description of your grinding job.

SIMONDS ABRASIVE CO.
Philadelphia, Pa.
Electric Furnace Plant, Simonds Canada Abrasive Co., Ltd., Arvida, P.Q.

SIMONDS ABRASIVE COMPANY
is a division of
SIMONDS SAW AND STEEL CO.
Fitchburg, Mass.
Saws, Machine Knives, Files

Other Divisions

SIMONDS STEEL MILLS
Lockport, N.Y.
Special Steels

SIMONDS CANADA SAW CO. LTD.
Montreal, Can.
Simonds Products for Canada

Wherever grinding figures in your manufacturing operations you can count on Simonds Abrasive Company Grinding Wheels for the kind of performance that 'ups' production and cuts costs. Complete quality control governs these production tools—beginning with crude abrasive produced by our Canadian electric furnace plant, Simonds Canada Abrasive Co., Ltd., and continuing through to the finished wheels stocked by our distributors. This, plus more than 50 years experience as a leading manufacturer of grinding wheels and abrasive products exclusively, enables Simonds Abrasive Company to offer you top wheel performance duplicated each time you buy Simonds Grinding Wheels.

SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PENNA. • DISTRIBUTORS IN ALL PRINCIPAL CITIES

Now! ELECTROMET can supply you with these TUNGSTEN products

Tungsten—to meet your every need—is now available from Electromet in a variety of products. Tungsten can be supplied to you as ferrotungsten, as tungsten metal powder, or as chemical compounds—calcium tungstate and ammonium paratungstate. Check this list for products to fill your requirements.

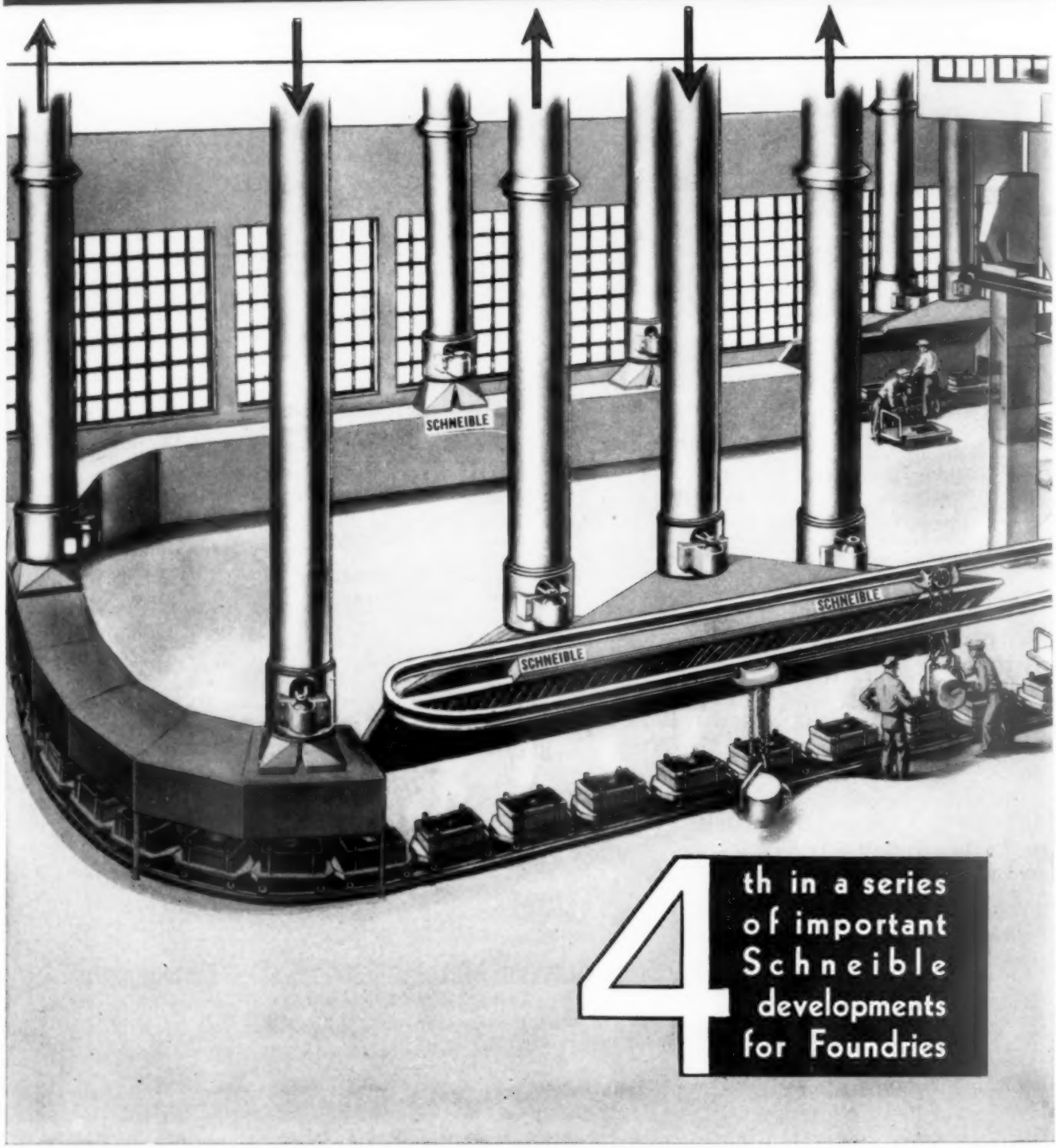
Product	Analysis	Form and Packaging	Uses
Ferrotungsten	Tungsten—70.00 to 80.00% as specified Carbon—0.60% max.	Crushed (¼ in. x down). Packed in barrels or steel drums.	Manufacture of high-speed tool steels, and other tungsten-bearing steels.
Tungsten Metal Powder	*99% Melting Grade* Tungsten—98.80% min. Carbon—0.25% max. *(Note: Premium grades are also available for uses requiring special fine-grained high-purity material.)*	Powder (65 mesh x down). Packed in barrels or steel drums.	Manufacture of tungsten-bearing non-ferrous alloys and tungsten carbide hard-surfacing materials.
Calcium Tungstate Nuggets	Tungstic Oxide (WO_3)—73.00 to 77.00%	Nuggets (⅛ to ½ in. diam.). Packed in 100-lb. paper-lined burlap bags.	Manufacture of tungsten-bearing tool steels. Blending with off-grade natural scheelite ores.
Calcium Tungstate	Tungstic Oxide (WO_3)—65.00% min.	White crystalline powder. Packed in 100-lb. paper-lined burlap bags.	Production of tungsten powder for hard-surfacing materials, cutting tools, lamp filaments, and X-ray targets; production of tungsten-bearing catalysts and luminescent coatings in fluorescent lamps.
Ammonium Paratungstate	*Melting Grade* Tungsten—70.50% min. Molybdenum—0.20% max Non-Volatile Residue—0.10% max. *Sinter Grade* Tungsten—70.50% min. Molybdenum—0.035% max. Non-Volatile Residue—0.035% max.	Dense white crystalline powder. Packed in 200-lb. fiber-board drums.	

For further information about these and other special tungsten products, write, wire, or phone one of Electromet's offices.

Electromet
TRADE-MARK
Ferro-Alloys and Metals

ELECTRO METALLURGICAL SALES CORPORATION
Unit of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
OFFICES: Birmingham • Chicago • Cleveland • Detroit
New York • Pittsburgh • San Francisco
In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario.

New "Open Side" Mold *features*



4th in a series of important Schneible developments for Foundries

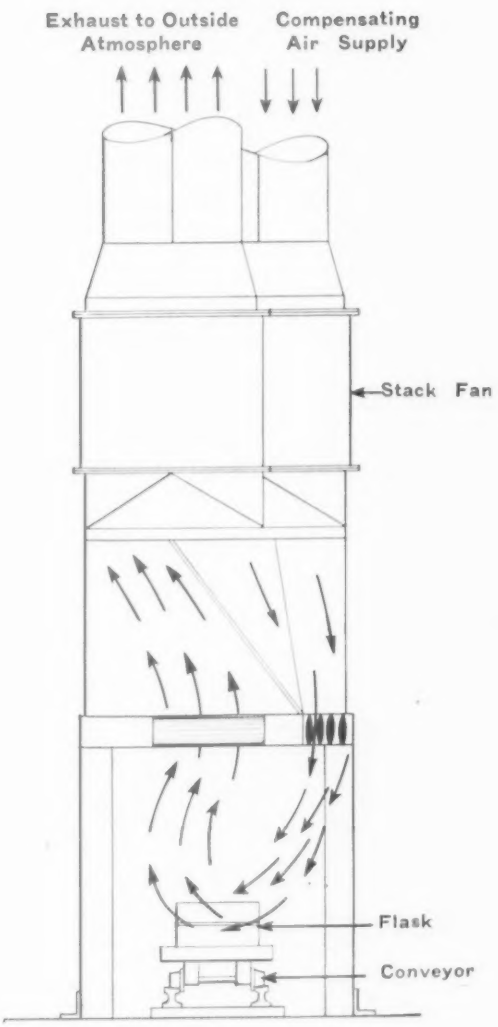
Cooling Conveyor Hood

Compensating Air Principle

Now, for the first time Schneible has made available to the foundry industry a hood for mold cooling conveyors which alone offers these advantages:

1. Has open side for observation of molds in transit to weight removal station. Easy removal of spillage—easier conveyor maintenance.
2. Protected by compensating air stream on open side of hood—smoke and heat prevented from contaminating foundry atmosphere.
3. Smoke and heat continuously exhausted through stacks.
4. Lower in height than standard hoods resulting in better visibility and ready accessibility.

The Schneible "Open Side" Hood has a divided plenum chamber with a steady stream of air taken from above the roof line (can be taken from below roof in summer) blanketing the cooling molds. This compensating air supply sweeps the hot molds on the conveyor and all smoke is literally blown into the exhaust portion of the plenum chamber. This section of the hood has adjustable louvers. Only a small amount of make-up air is taken from the foundry. It's 1, 2, 3, fresh air in—smoke out! Mold cooling enclosures for large molds can be designed *without any* side walls. Weight and clamp removal stations can also be ventilated by Schneible Hoods with compensating Air Supply—better working conditions—more comfort for workers. Send for further details on this remarkable addition to the Schneible Line of Dust Control and Ventilation Equipment for Foundries.



CLAUDE B. SCHNEIBLE CO.
2827 Twenty-fifth St., Detroit 16, Michigan
Engineering Representatives in Principal Cities

SCHNEIBLE

LIQUID VAPOR INTIMATE CONTACT EQUIPMENT for DUST COLLECTION ABSORPTION CONDENSATION AND TEMPERATURE REDUCTION

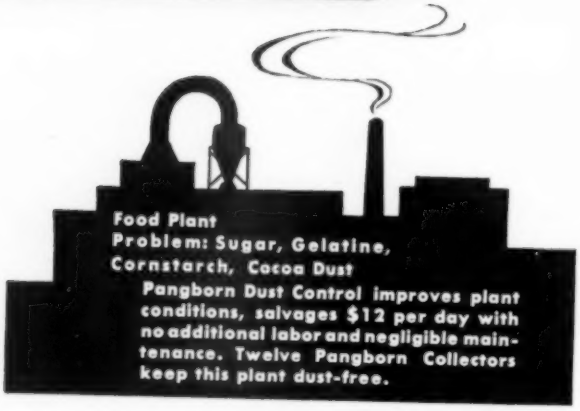
Pangborn

Stops Dust on Industry Row

Foundry
Problem: Burned Sand
Pangborn corrects problems impairing worker's efficiency . . . Speeds up production . . . Rings up additional indirect savings of 25%. Negligible operating and maintenance costs prove PANGBORN a sound investment.

Refractory
Problem: Ganister Dust
User claims over-all savings of $35 per day over operating and maintenance costs of $18 per day . . . Comments two Pangborn Collectors are a good investment.

Soap Manufacturer
Problem: Soap Powder
Pangborn system reduces plant maintenance at no cost. Salvage of $250 per year outweighs operating and maintenance costs of $180 per year. Pangborn system has paid for itself through increased efficiency, sanitation, salvage.


Food Plant
Problem: Sugar, Gelatine, Cornstarch, Cocoa Dust
Pangborn Dust Control improves plant conditions, salvages $12 per day with no additional labor and negligible maintenance. Twelve Pangborn Collectors keep this plant dust-free.

. . . These are Actual Cases of How Pangborn Stops the DUST HOG!

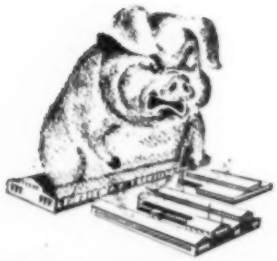
PANGBORN CAN HELP YOU no matter what your Dust Problem is! The hungry, profit-eating "Dust Hog" is licked when he meets up with Pangborn Dust Control Equipment.

The four cases shown here are just a few of many Pangborn users. A substantial portion of these progressive manufacturers report savings in reclaimed dust by-products to such a degree that their PANGBORN systems are more than paying for themselves. Even in cases where the reclaimed dust is purely waste, the savings in worker efficiency, increased production and improved quality of work make Pangborn Dust Control a sound investment.

Experienced PANGBORN engineers will make a "Dust Pocket Survey" of your plant at no cost to you. The survey may reveal similar opportunities for you to turn dust losses into profits.

Write for complete information on Pangborn Dust Control, Bulletin 909A. Address: PANGBORN CORPORATION, 300 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the Latest Developments in Dust Control and Blast Cleaning Equipment



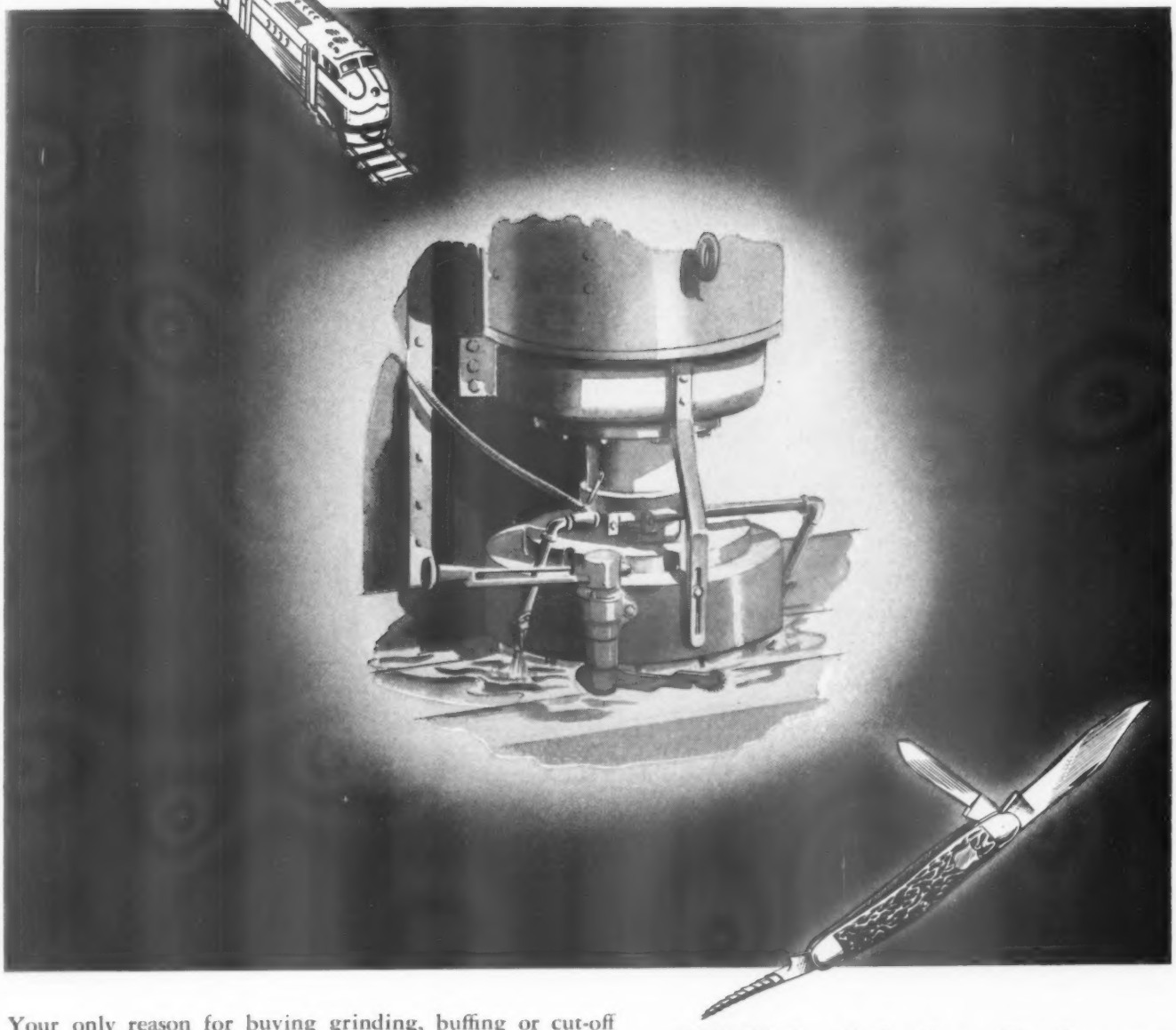
PANGBORN STOPS THE DUST HOG
from stealing your profits

Pangborn

DUST CONTROL

TURNS DUST LOSSES INTO PROFITS

FROM RAILROADS TO CUTLERY



Your only reason for buying grinding, buffing or cut-off equipment is to make production more profitable. To help you do this, Bridgeport makes machines known all over the world for ruggedness and advanced engineering. Bridgeport engineering includes not only equipment engineers but abrasive specialists. Perhaps most important of all we "live" with every installation until the buyer is satisfied that he never made a sounder investment in production machinery.

Your inquiry regarding Bridgeport Grinders will have prompt, authoritative attention.

Just off the press . . . A new catalog on Bridgeport's New Model 400 Cutlery Grinder. Write for it today.

FIRST in Grinding Equipment

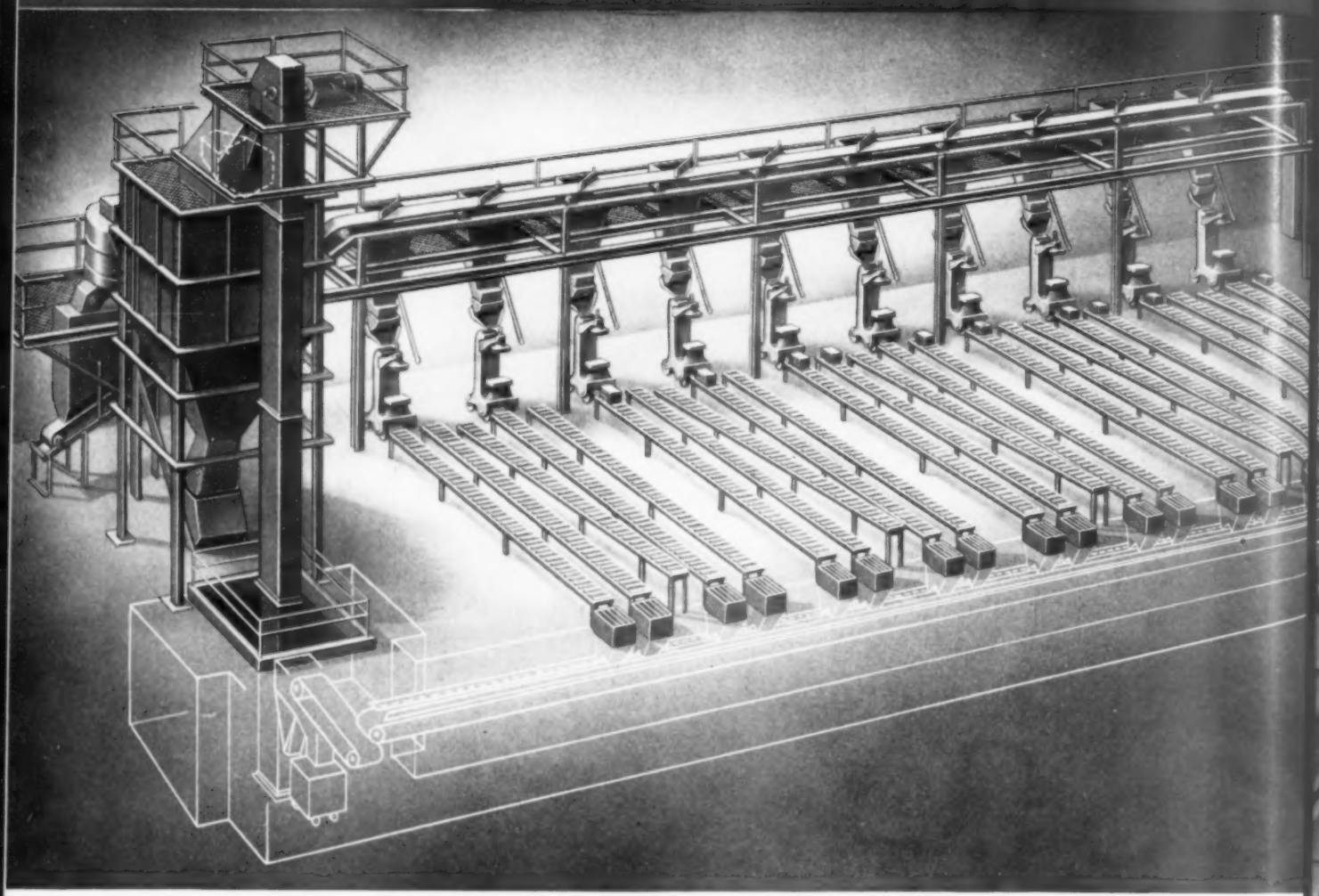
Bridgeport

GRINDERS

Horizontal Face Grinders, Vertical Grinders, Cutlery Grinders, Buffing Lathes, Knife Grinders, Floor Grinders, Abrasive Cut-off Machines, Buxite Abrasive Wheels.

BRIDGEPORT SAFETY EMERY WHEEL CO.
1302 West Broad Street, Stratford, Conn.

NATIONAL proved these 2 points



PROVED THE ABILITY OF NATIONAL MECHANIZED EQUIPMENT TO PRODUCE MOLDS AT AN EXTREMELY HIGH PRODUCTION RATE PER MOLDER . . .

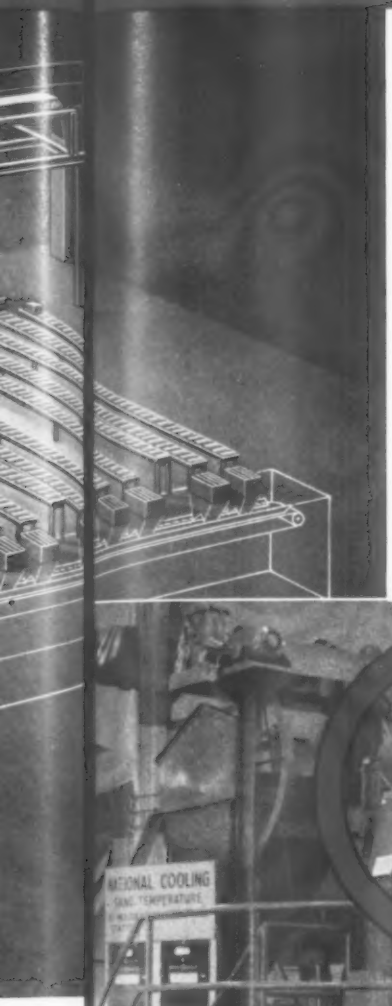
Judging by the constant crowd of foundrymen who watched the actual mold production operations at the 1948 Foundry Show, National certainly offered one of the top attractions for thousands of show visitors . . . And judging from their comments, they were greatly impressed with the speed and accuracy with which molds were being produced on National mechanized equipment, from correct sand preparation to finished molds, and through the mechanized shakeout operation.

This exhibit included the equipment for one molder's station, and formed the basis for a complete "progressive" unit such as that shown above. In this same manner, smaller foundries can start with a Simpson Mixer and Bucket Loader, and then add all other equipment at any time to form a complete sand preparing system . . . including screening and separating unit; elevated platform and extended bucket loader; storage bin; sand distributing equipment; mold conveyors; shakeout conveyors, etc. Thus, long-range planning is simplified through the use of standard National *"Progressive"* sand preparing units.

SEND FOR THIS NEW ILLUSTRATED BOOKLET . . .

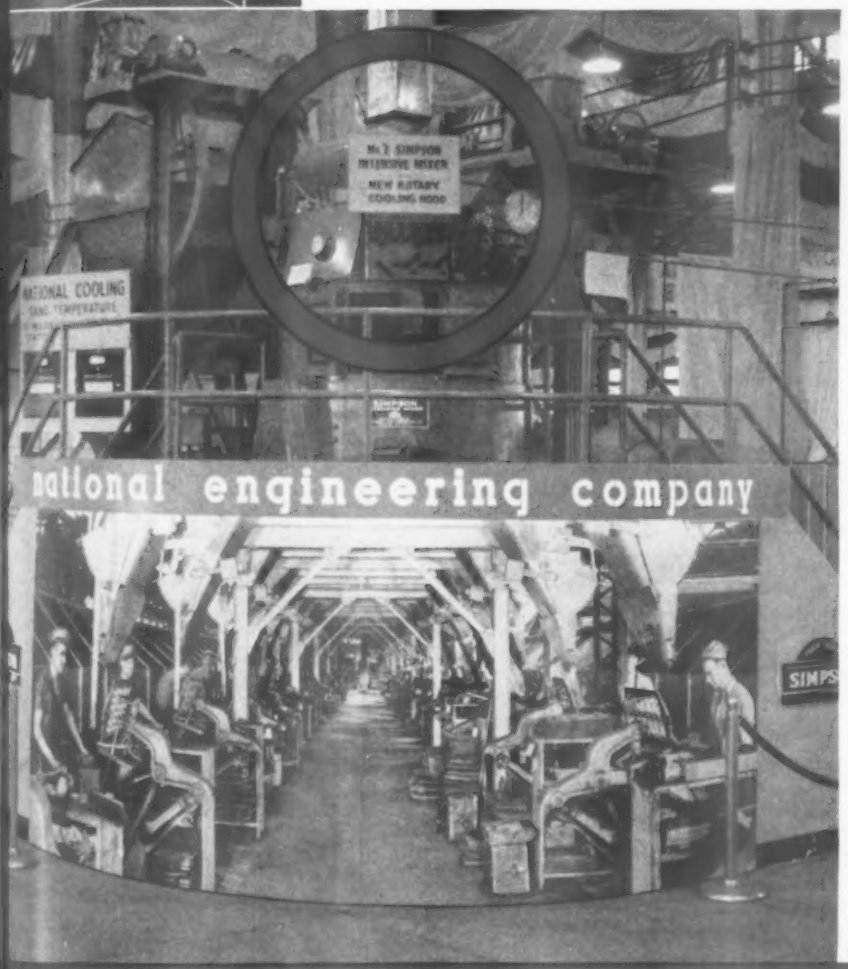
This new informative brochure outlines methods by which standardized "step-by-step" units allow smaller foundries to plan for future expansion with a minimum initial equipment investment. Call or write for your copy of the *National "Progressive" Unit Booklet* today.

...at the 1948 Foundry Show!



1. PROVED THE ABILITY OF THE NEW NATIONAL ROTARY COOLING HOOD TO LOWER MOLDING SAND TEMPERATURES FROM OVER 400° F. TO WITHIN 20 DEGREES OF ROOM TEMPERATURE!

If you were one of the thousands of visitors who attended the recent Foundry Show, you will probably recall the scene pictured below . . . the mixing platform of National's exhibit, where the No. 2 Simpson Mixer, together with the new National Rotary Cooling Hood *demonstrated that incoming molding sand, heated to over 400° F., was cooled down to within 20° of room temperature within the mixing cycle.* From the mixer, this cooled sand was automatically discharged into the molder's hopper and used for actual production of molds, simulating actual foundry conditions.



HOW THE NATIONAL ROTARY COOLING HOOD LOWERS SAND TEMPERATURE:

The basic principle employed in the new Rotary Cooler is the proved mechanical principle of cooling through evaporation. Excess moisture is added to the sand, and air at high velocity is forced through the sand as it passes over the plows. As the moisture is evaporated, the heat in the sand is transferred to the vapor generated, and carried out of the mixer. A slight vacuum is maintained in the mixer to prevent dust laden air from escaping into the work area.

LET A NATIONAL ENGINEER SHOW YOU HOW THE NEW ROTARY COOLING HOOD WILL HELP SOLVE YOUR HOT SAND PROBLEMS . . .

Call or write for details!

MANUFACTURERS ASSOCIATION, INC. FOUNDRY EQUIPMENT

NATIONAL *Engineering Company*

608 Machinery Hall Bldg. • Chicago 6, Illinois

Manufacturers and Selling Agents for Continental European Countries — The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia — August's Limited, Halifax, England. For Canada — Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand — Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

IRONTON BERLITE

Photo Courtesy—Chicago Pneumatic Tool Co.

Ask us for Service Data on "Ironton Berlite"

Do you use brick lined ladles? "Ironton Berlite" used as a mortar and wash coat increases the life of the brick lining at least 400 per cent, in ladles from 1 to 10 tons capacity. There is no failure at the brick joints, and no slagging in the ladles. For cleaner castings and less ladle repair work, use "Ironton Berlite".

"Ironton Berlite" also gives excellent service in hand shank ladles, cupola troughs, teapot spouts, rammed tap holes, and for laying up cupola blocks in the well and melting zone.

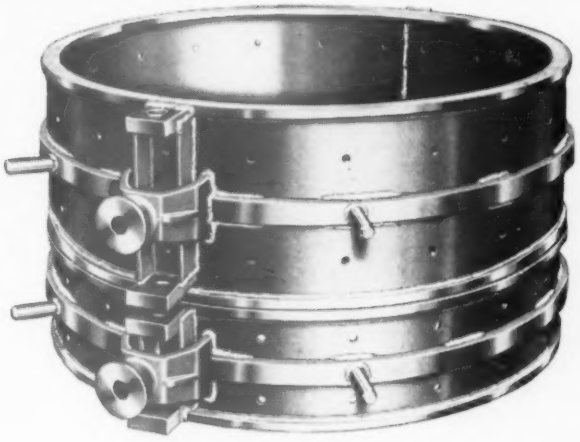
THE IRONTON FIRE BRICK COMPANY

RELIABLE REFRACTORIES

IRONTON OHIO

Built for the Foundry by Foundrymen!

BS & B
WELDED STEEL
FOUNDRY FLASKS



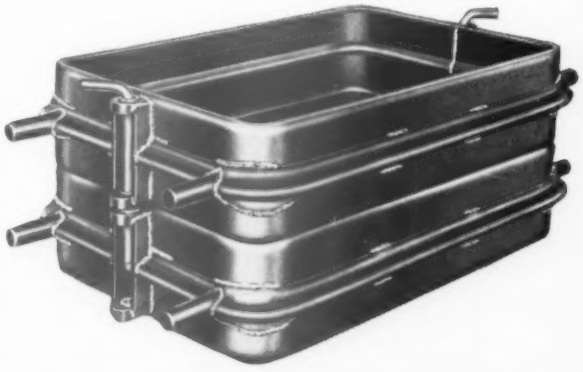
All along the production line of the vast Black, Sivalls & Bryson plant, the master hand and eye of the experienced foundryman has control. Your foundry flasks are precision tools, and B S & B craftsmen and modern facilities make them so. Huge forming presses shape the steel exactly as required in your specifications.

Welders with the finest electric arcs produce welds as strong as the metal itself. Yet B S & B Flasks are lighter, easier to handle. Hydraulic presses remove any distortion, make drag and cope perfectly true. Both parting line and strike-off side of each section are carefully ground to provide a tight, level joint between sections.

Twin drills place pin lugs with meticulous care. Inspections are made after each step, and only the perfect flask gets through.

Investigate for yourself the distinct advantages of B S & B Welded Steel Foundry Flasks. Call your nearest distributor, or write today for complete information.

- GREATER STRENGTH, LESS WEIGHT
- SAVE TIME AND LABOR
- BUILT TO YOUR ORDER . . . ANY SHAPE OR SIZE FOR EVERY PURPOSE.
- RAPID DELIVERY ASSURED



BLACK, SIVALLS & BRYSON, INC.

Special Products Division

Power and Light Bldg., Kansas City 6, Mo.

AUTHORIZED BS&B DISTRIBUTOR

• B S & B Bottom Boards and Core Plates can also add speed to your production. Ask for them.

ORDER TODAY
From Your Nearest Distributor

BIRMINGHAM, ALA.
Foundry Service Co.

BOSTON, MASS.
Klein-Farris Co., Inc.

BUFFALO, N. Y.
Queen City Sand & Supply Co.

CHICAGO, ILL.
S. Obermayer Co.

CINCINNATI, O.
Hill and Griffith Co.

CLEVELAND, O.
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DAYTON, O.
Fenton Foundry Sup. Co.

DETROIT, MICH.
Wolverine Foundry Sup. Co.

EDWARDSVILLE, ILL.
Midwest Foundry Sup. Co.

ELMIRA, N. Y.
F. F. Shortsleeve Co.

FT. WORTH, TEX.
Ralph A. Carlson

LOS ANGELES, CALIF.
Independent Foundry Sup. Co.

MINNEAPOLIS, MINN.
Foundry Supply Co., Inc.

MONTREAL, CAN.
Canadian Foundry Sup. & Equipment, Ltd.

OAKLAND, CALIF.
Pacific Graphite Co., Inc.

PHILADELPHIA, PENN.
Pennsylvania Foundry Sup. & Sand Co.

PITTSBURGH, PENN.
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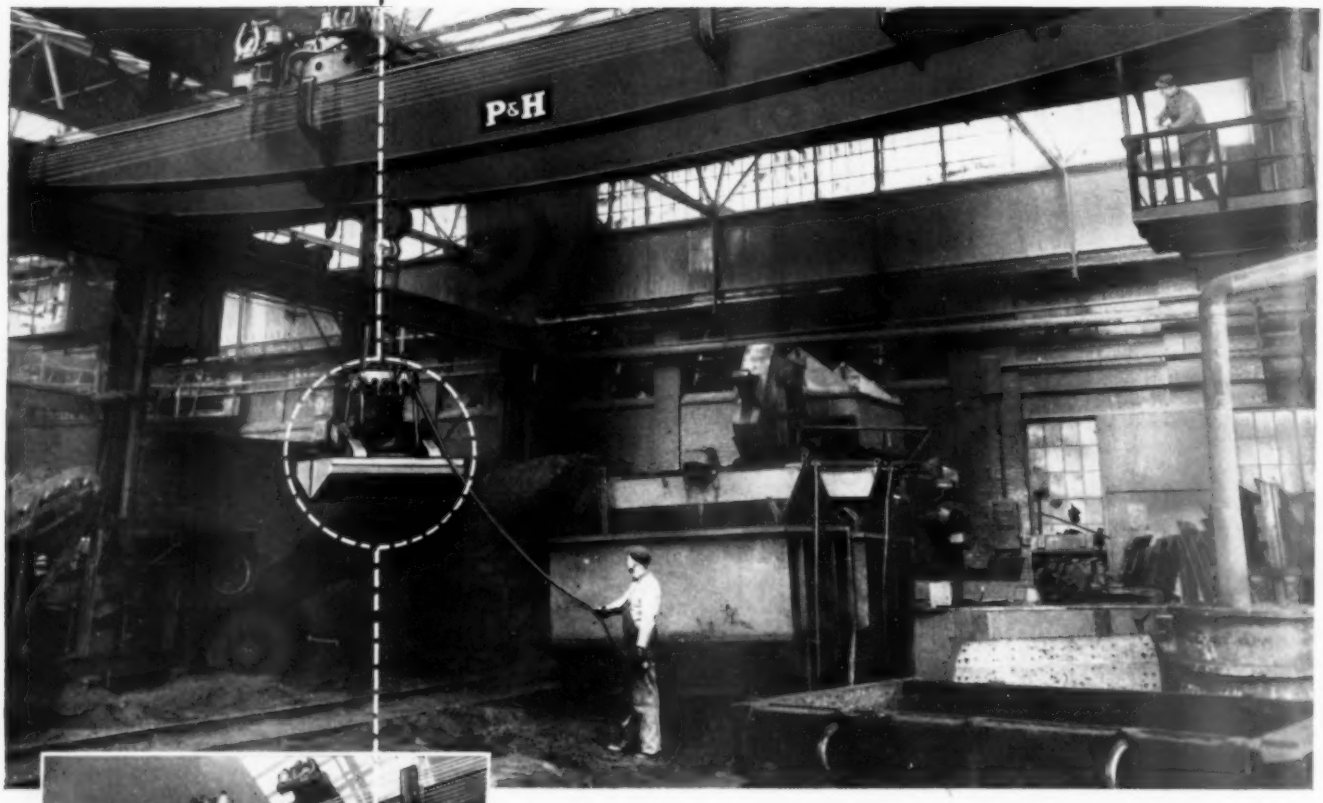
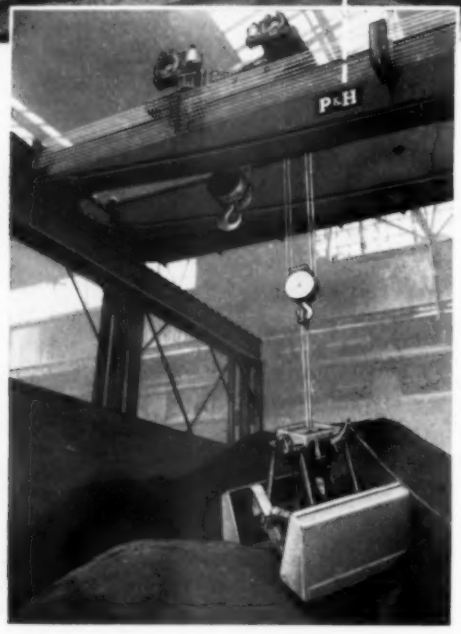
M. W. Warren Coke Co.

TORONTO, CAN.
Canadian Foundry Sup. & Equipment, Ltd.

P&H SINGLE LINE GRAB BUCKETS





a *"Natural"* in foundry service!

In a matter of seconds you can attach the P&H Single Line Grab Bucket to your crane hook and it's ready to go to work. It's as simple as that — and it provides easy, accurate one-man operation. It works fast, bites deep, picks up clean.

Here's the fast, easy way to handle all kinds of bulk materials — sand, coke, crushed stone, cinders, etc. It's widely used to unload cars, dig pits, fill flasks, etc. A "natural" for foundry use if there ever was one.

Available in capacities from 1/2 to 2 1/2 yds. Write for all the facts about it. Ask for Bulletin C-27.

P&H

GRAB BUCKETS
4405 West National Avenue
Milwaukee 14, Wis.

HARNISCHFEGER CORPORATION
ELECTRIC CRANES · EXCAVATORS · ARC WELDERS · P&H · HOISTS · WELDING ELECTRODES · MOTORS

If you check this

the need for an
expertly engineered
fume exhaust system

Or this

the need for an
expertly engineered
dust exhaust system

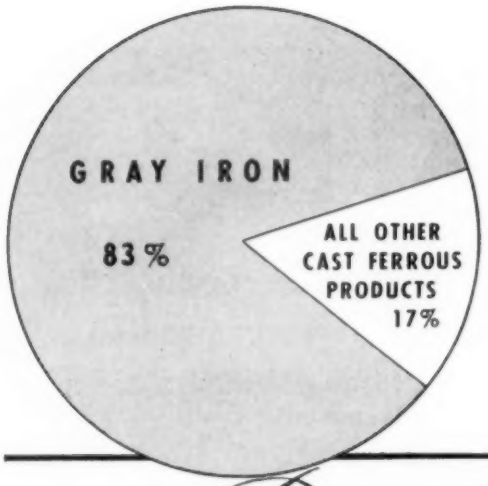
Then it will pay you to check this

For foundry fume and dust control—the right equipment for any job . . . for standard exhaust, for foundry shakeout systems, or for core ovens.

Westinghouse Electric Corporation
Sturtevant Division
50 Readville Avenue, Hyde Park, Boston 36, Mass.
Because Sturtevant is
Manufacturing Headquarters
For All Types of
Air-Handling Equipment and Systems

Westinghouse
Sturtevant Division

Sturtevant fans used for cupolas



A *Big Piece* OF A BIG PIE

Of all foundry products made in the United States, over 80 per cent are gray iron—12,540,960 tons of gray iron products produced last year.

A giant industry, yes. But not an industry of giants. Some 2500 individual foundries produced this volume, supplying gray iron parts to virtually every metalworking industry in the country.

Gray Iron Founders' Society, representing nearly 75 per cent of the industry's capacity, has launched a long-range program of advancement for the mutual benefit of users and producers of gray iron components.

"MAKE IT BETTER WITH GRAY IRON"

Important points in this program are:

1. Assistance to users and potential users of gray iron in making their products better, in lowering their costs, or both.
2. Consultation and service to help members improve their products and processes.
3. Education—within the membership, in technical schools and throughout industry as a whole—on the uses and characteristics of gray iron components.

Consider These Gray Iron Characteristics:

1. Corrosion resistance
2. Machinability
3. Damping capacity
4. Rigidity
5. Abrasion and wear resistance
6. Heat resistance
7. Low notch sensitivity
8. Durability
9. Castability—dimensional accuracy
10. Wide selection of mechanical properties

GRAY IRON FOUNDERS' SOCIETY, INC.

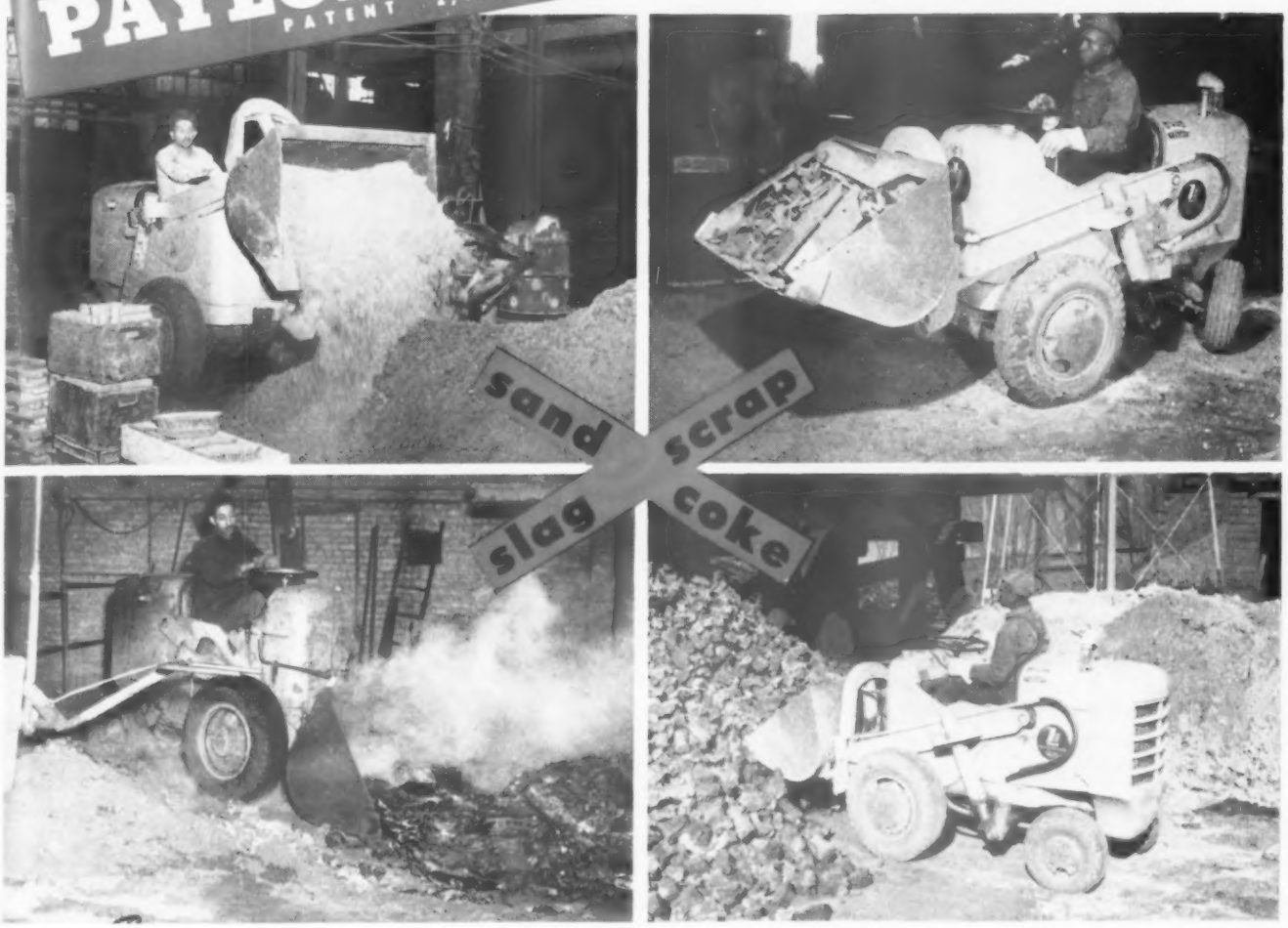
GRAY IRON FOUNDERS' SOCIETY, INC. *33 PUBLIC SQUARE CLEVELAND 13, OHIO*

HOUGH PAYLOADER

SAY "HUFF"

PATENT 2,412,323

a workhorse on wheels!



Save Time, Money, Man Hours... Boost Production

Hundreds of foundries have installed Hough Payloaders and found them one *sure* way to lick rising costs, solve manpower shortages and increase tonnage. A Payloader is a workhorse on wheels . . . actually pays for itself within a few months by the savings in time and manhours and increased production which result. Typical of Payloader performance is the case of a Model HA, 10½ cu. ft. size, that saved 5,000 hours of labor in the first four months of operation at a Midwestern foundry. Speedily twisting, turning and traveling, Payloaders go in and out of box cars and bins, up and down ramps, through narrow doorways and aisles . . . unload, load, transport and dump sand, slag, scrap, castings, coke and other bulk materials. They do quickly and easily many material handling tasks that are now slow, laborious and costly.

It will pay you to investigate the advantages of Payloaders for your own foundry. Write today for literature and the name of the Hough distributor near you who sells and services these modern material-handling miracle workers.

SEND TODAY **for literature on the Model HA 10½ cu. ft. Payloader, the ¾ yd. Model HF and the 1¼ yd. Model HL.**

THE FRANK G. HOUGH CO.

703 SUNNYSIDE AVENUE, LIBERTYVILLE, ILLINOIS

TRACTOR SHOVELS SINCE 1920

COLEMAN Ovens...

FOR GREATEST PRODUCTION AT LOWEST POSSIBLE COST

"more efficient... more dependable... more economical", is what enthusiastic owners everywhere say about their Coleman Ovens!

...H. S. GULICK, The New York Air Brake Co.

"Our Coleman Tower Oven has been in operation continuously twenty to twenty-four hours per day, seven days per week...which certainly proves its dependability under uninterrupted operation...our spoilage is less and our entire operation is more economical."

...S. V. WOOD, Minneapolis Electric Steel Castings Co.

"We are enthusiastically complimenting you on the quality of our Coleman Oven installation and its operation...the ovens have been entirely satisfactory and the efficiency which they have attained has been beyond our expectations

...J. D. JAMES, The Cooper-Bessemer Co

"Our Coleman Ovens have seen a lot of heavy service and are doing a remarkabl fine job in every way...the savings fr our shortened drying cycles, absolute uniformity in mold drying, and elimination of mold and casting scrappage have long since returned our investment in Coleman Ovens."

...A. E. SCHOBECK, Jamestown Malleable Iron Corporation

"Our Coleman Tower Core Oven has 'out performed' your specifications and is giving entire satisfaction."

● **When you want to get the real facts about equipment you plan to buy...ask a user! Owners of Coleman Ovens are glad to recommend this equipment because of these outstanding advantages:**

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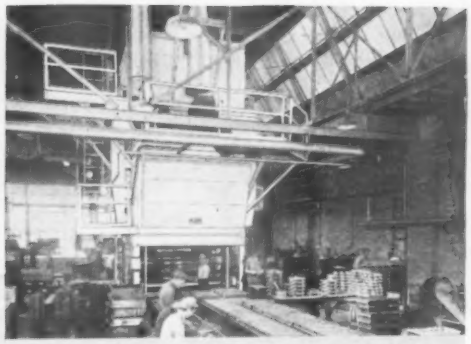

COLEMAN TOWER OVENS
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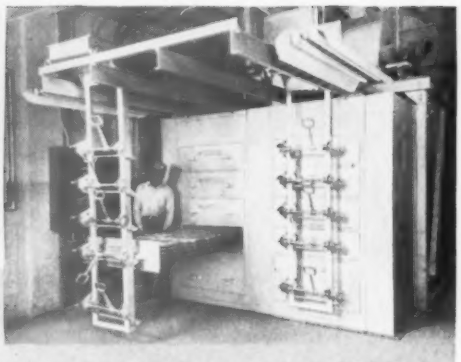
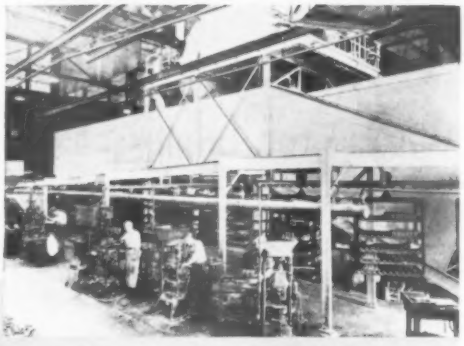
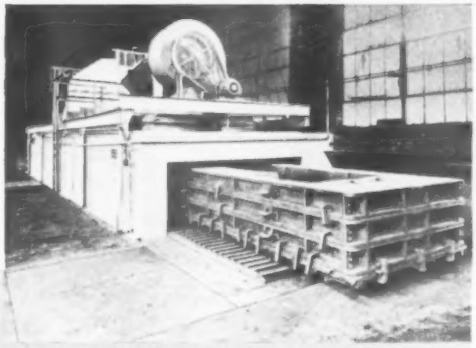


COLEMAN ROLLING DRAWER OVENS
For small and medium cores. High-speed production with limited floor space.

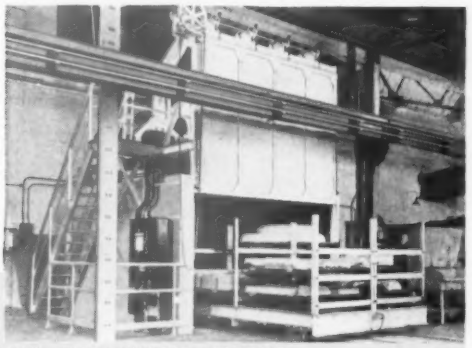


COLEMAN HORIZONTAL CORE OVENS
Overhead conveyor ovens specially designed for large scale production foundries in such fields as agricultural, automotive, etc.

COLEMAN TRANSRACK OVENS
For use with portable racks to reduce handling labor. Very efficient where ample floor space is available.



COLEMAN CONTINUOUS MOLD OVENS
For high speed continuous drying of molds. These ovens provide amazing drying speed at a fraction of the cost of former methods.



COLEMAN CAR-TYPE OVENS
For baking large cores or drying molds. Coleman Car-Type Ovens are used by most of the leading producers of heavy castings.

COLEMAN PORTABLE CORE OVENS AND COLEMAN PORTABLE MOLD DRYERS ARE OTHER MEMBERS OF THE COLEMAN FAMILY OF COMPLETE CORE BAKING AND MOLD DRYING EQUIPMENT

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BUILDERS OF COLEMAN AND SWARTWOUT OVENS

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COLEMAN
CORE AND MOLD OVENS

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CLECO GRINDERS have the high power capacity to maintain speed under heavy loads — yet the built-in governor valve minimizes air consumption and reduces wear-and-tear under no-load conditions.

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Bulletin No. 80A describes the complete line of Cleco Grinders. Write now or contact our nearest distributor or dealer.

Back of Cleco Products... with 25 years experience in precision manufacturing, is the REED ROLLER BIT COMPANY, one of the largest companies of its kind in the world.

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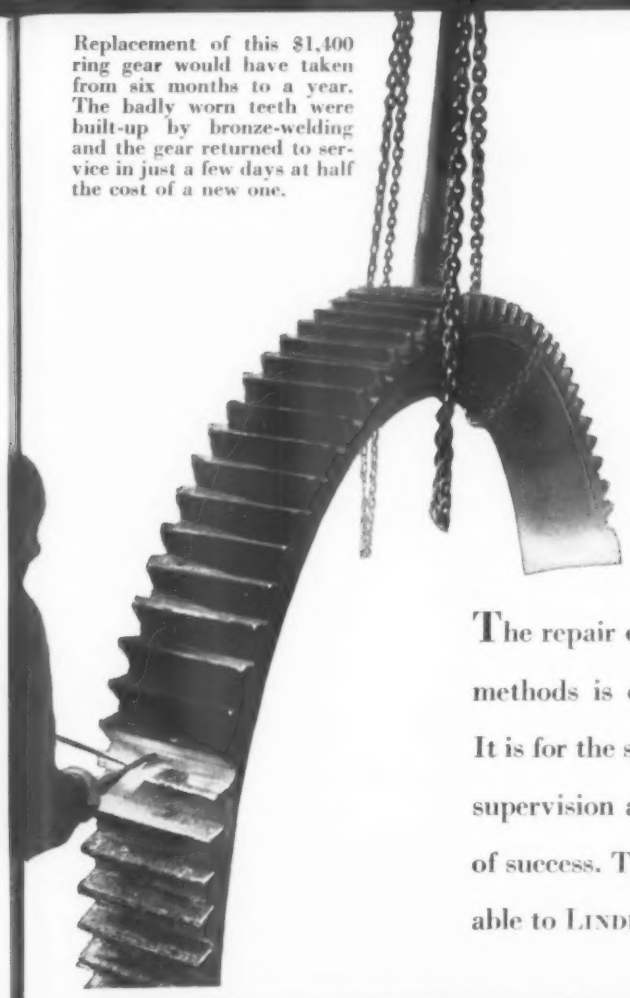
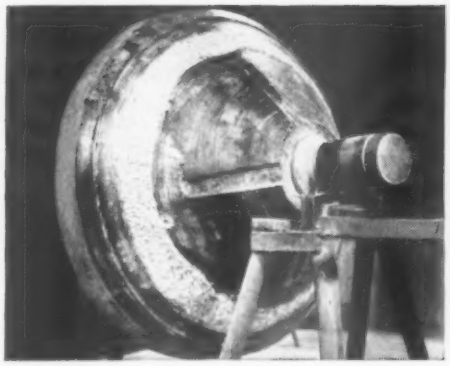


Replacement of this $1,400 ring gear would have taken from six months to a year. The badly worn teeth were built-up by bronze-welding and the gear returned to service in just a few days at half the cost of a new one.

Keeping the "wheels" going 'round

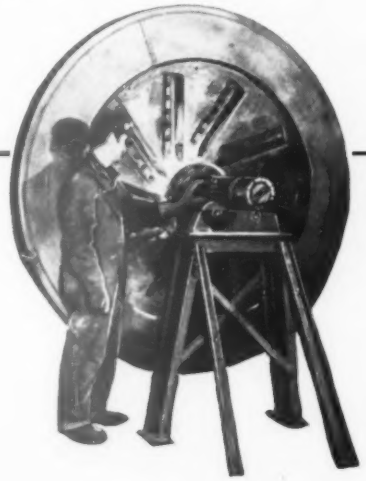
The repair of vast quantities of equipment by oxy-acetylene methods is of course routine for plant maintenance crews. It is for the special job, however, that the LINDE serviceman's supervision and work proves so valuable and gives assurance of success. This skilled, specialized assistance is always available to LINDE customers. Just phone the nearest LINDE office.



Bronze-welding this cast steel cone crusher head saved $1,000. The crack, which ran completely around the head for a distance of 9½ ft., extended through the thickness of the casting in several places. It was veed out by flame-gouging.

This cast iron steam hammer cylinder weighs 4,000 lb. Two large cracks, one on each side of the cylinder wall, were bronze-welded in only 14 hours. A new casting would have taken 16 weeks to obtain and would have cost more than 10 times as much.

Flanges are quickly joined to cast iron pipe sections by bronze-welding. LINDE supplies several bronze rods to meet varying service requirements.



Bronze-welding effected a considerable saving of cost and time when four spokes of this huge cast iron pulp-chipper wheel was cracked at the hub.

Linde

The word "Linde" is a registered trade-mark of The Linde Air Products Company.

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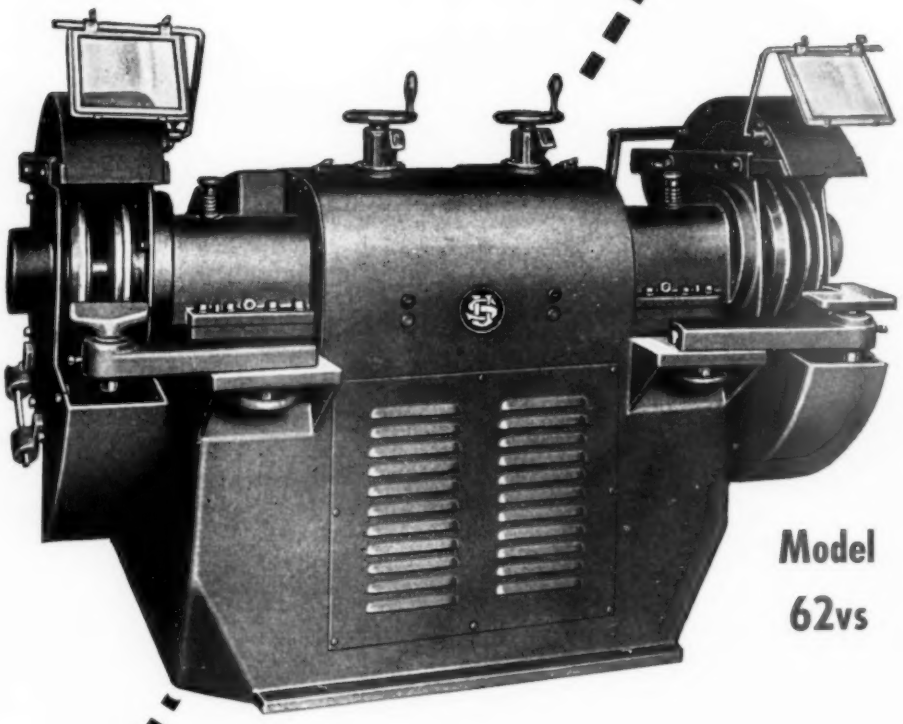
INSURE PERFECT LOW-COST GRINDING IN YOUR FOUNDRY



Model 62vs

Foundries, large or small, which insist on perfect performance and low costs choose Model 62VS. Results show INCREASED PRODUCTION, LONGER wheel life and MOST ECONOMICAL OPERATION.

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Maximum peripheral speed can be maintained for the entire life of the wheels. WHEEL GUARDS ARE ADJUSTABLE TO WHEEL WEAR and are interlocked with speed changer. Totally enclosed fan-cooled ball-bearing motors. Push button stations on front of pedestal. Heavy chrome-manganese spindles operate in heavy duty ball bearings which are enclosed in dustproof housing with inner and outer oil seals.

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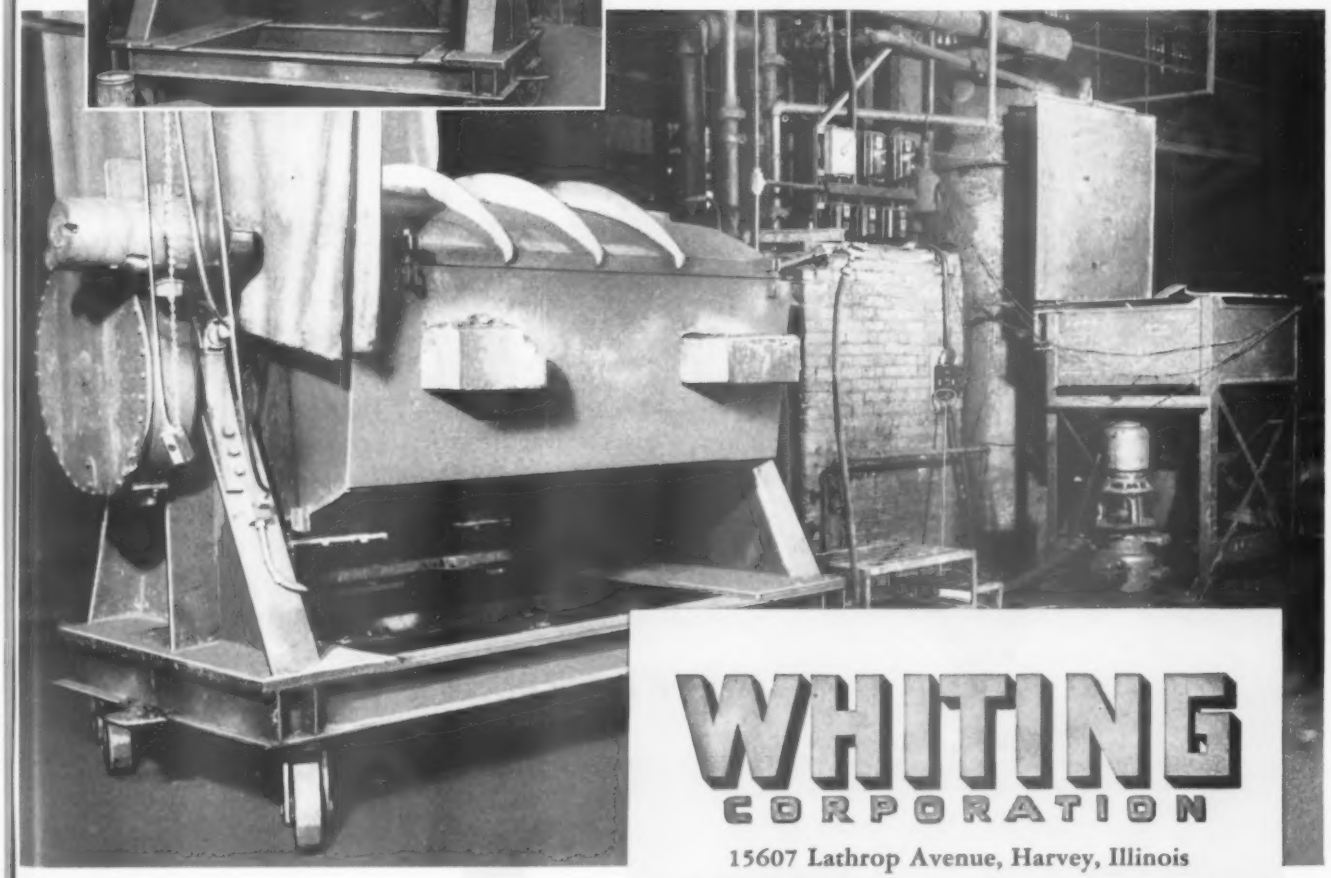
THE WHITING HEATED METAL MIXER is a 3-ton tilting furnace fired with pulverized coal (or oil) and operated by push-button control. It helps to keep composition uniform and also can be used for composition adjustments.

Being direct-fired (pulverized coal or oil), there is considerably less temperature loss than in a conventional holding unit.

Front view shows the pouring spout.

Typical installation of Whiting 3-Ton Heated Metal Mixer, showing coal feed hopper and Whiting #1 Pulverizer at right. Larger units are also available.



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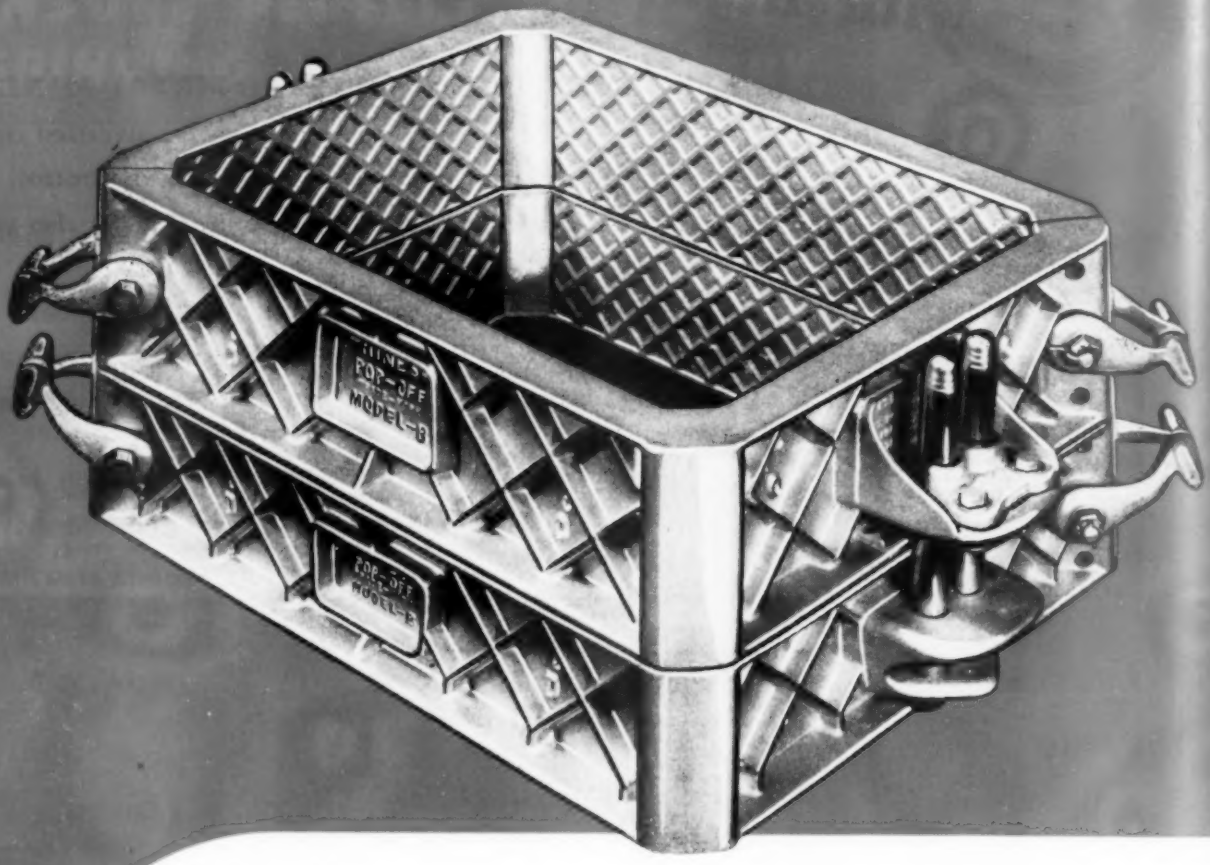
Hines Model "B"

ALUMINUM POP-OFF FLASK

for high production on light squeezers



HINES
POP-OFF
(Trademark Reg. U. S. Pat. Off.)
FLASK

The LIGHTER WEIGHT

This illustration of the Hines Model "B" Aluminum Pop-Off Flask is a good picture of a good product—but many of its important points can't be *seen.* Some of these points are LIGHT WEIGHT, EXTREME DURABILITY, LOW PRICE, UTILITY and the fact that it will ELIMINATE SHIFTS. Hines Flasks are designed to "make the tough jobs easy"; they set a pattern for economical foundry operation.

FOR BEST RESULTS, USE HINES JACKET

THE HINES

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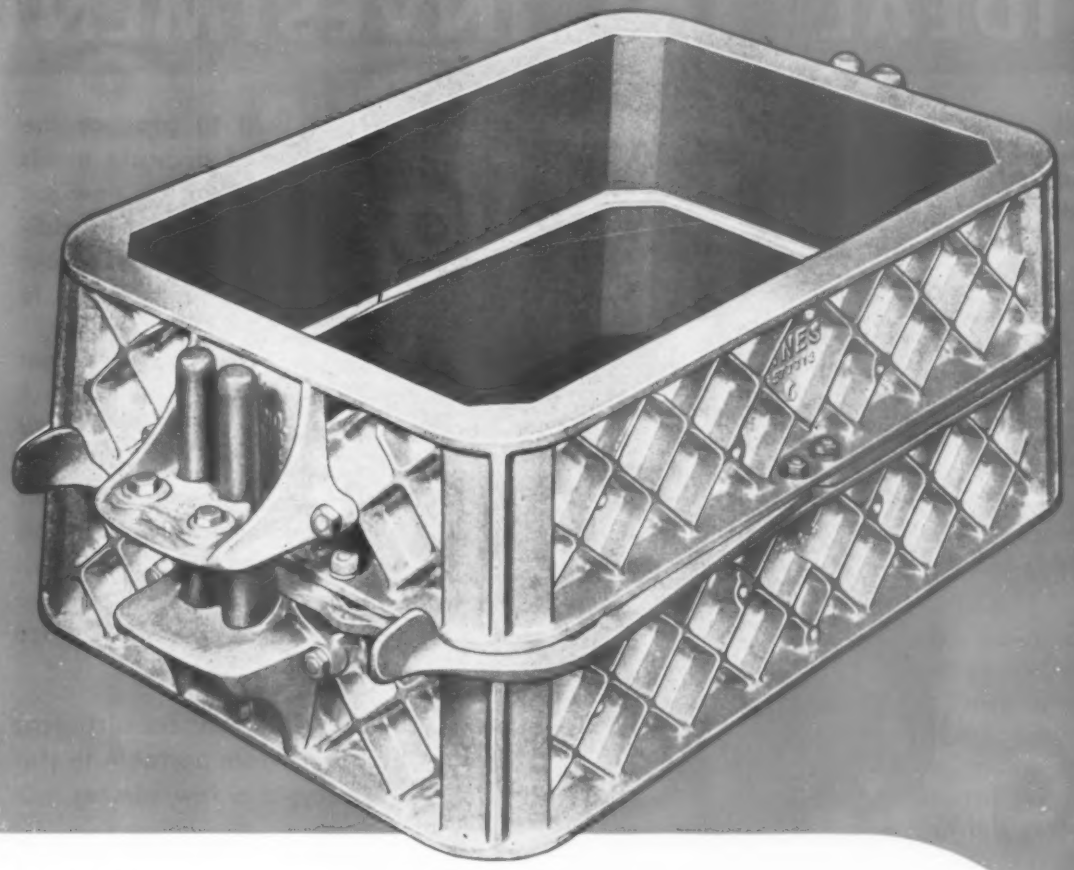
Hines Model "A"

ALUMINUM SLIP FLASK

for light squeezers . . . pattern casting . . . trade schools



METALLIC FLASKS

The Hines Model "A" Aluminum Slip Flask is particularly recommended for light squeezer work, pattern casting and for trade schools. It is much lighter in weight than the ordinary flask, making the molder's work that much easier. It costs less, outlasts other flasks, and reflects credit on an organization that has been exclusively a builder of flasks and jackets over a period of twenty-five years.

All Hines Flasks are fully protected by U. S. and Foreign Patents

THEY ALWAYS FIT THE MOLD SNUGLY

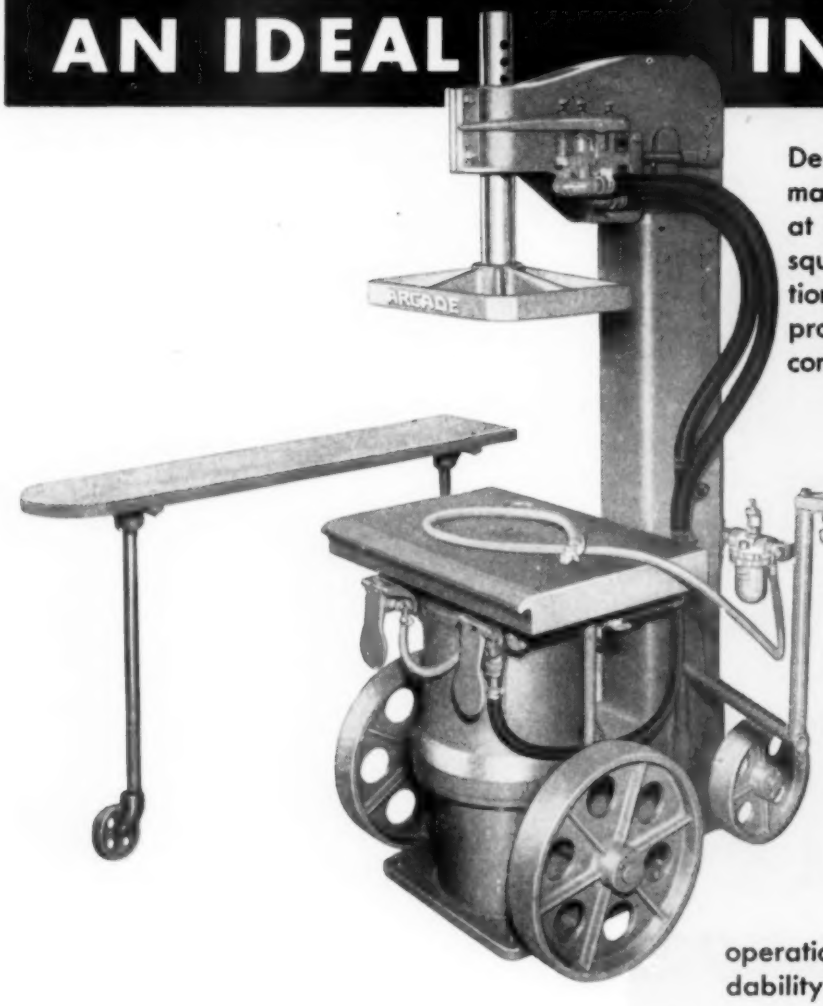
FLASK CO.

CLEVELAND 11, OHIO

Interchangeable cylinders

10-INCH *and* 12-INCH

MAKE THIS MACHINE AN IDEAL INVESTMENT



Designed and built to produce the maximum number of accurate molds at lowest possible cost, this new jolt squeezer by Arcade has the additional virtue of adaptability to your production needs for many years to come . . .

You may want a 10-inch squeezer now; then at any time, as your requirements change, you can replace the 10-inch cylinder with a 12-inch cylinder **—in a few minutes.** Or vice versa.

Also, you can convert your machine from portable to stationary, in a few minutes.

Note, too, these excellent features that make for ease of operation, low cost maintenance, dependability and production economy . . .

PERFECT BALANCE — and fine anti-friction bearings minimize manual effort, lessen human fatigue

FEW WORKING PARTS — means low maintenance

RUGGED CONSTRUCTION — backframe, base and squeezer arm of heavy steel

In addition to practical design and good construction, you get the benefits of Arcade experience and Rockwell stability. For more than 50 years Arcade molding machinery has been a useful factor in the growth of America's foundry industry.

Write for Bulletin 120 — and WATCH ARCADE for further important developments

ARCADE

MANUFACTURING DIVISION

ROCKWELL MANUFACTURING COMPANY

FREEPORT, ILLINOIS

Board Action Recognizes Importance of Castings

PLANNING for the mobilization of industry in event of a possible war emergency has been making considerable progress under the direction of several government agencies. The National Security Resources Board has been preparing an overall plan covering the co-ordination of military, industrial and civilian mobilization. The Munitions Board of the Military Establishment has been setting up industry advisory committees, conducting plant surveys and developing general broad procedures relating to military procurement, production and distribution. The various branches of the military establishment are working with industry to develop materials and industrial production methods which will meet the ever changing needs of the services.

The Munitions Board now is engaged in a survey of some 11,000 industrial plants to determine individual plant capacities, types of products which each company is best fitted to produce, and other pertinent information needed by the Army, Navy, and Air Force. From this study, which will be kept current by a perpetual inventory, the Munitions Board will be in position to allocate production capacity of specific industrial plants on the basis of requests from the Armed Services.

To help industrial managers think of their own plant's role in an emergency, the Munitions Board recently has issued an interesting booklet entitled "Military Procurement—A Guide for Joint Industry-Military Procurement Planning." The guide provides an extensive check list of questions, which need not be answered and returned, but which will give top management an opportunity to determine just where their own organization can fit into the plans for military procurement. Every foundryman should obtain a copy of this guide and give it careful study. Consideration of the problem now may improve the chance of survival in total war.

Recent action of the Munitions Board and the Iron and Steel Industry Advisory Committee in recommending the establishment of a separate Foundry Industry Advisory Committee embracing producers of gray iron, malleable iron, steel and nonferrous castings should be a source of gratification to the foundry industry and to the National Castings Council, which developed the idea. Surely this is an important step in planning the mobilization of this industry. Through this committee, when it is activated, the Armed Services and other government agencies will learn more about the essentiality of castings in our national defense, and the foundry industry will be in position to render maximum service to this nation in time of emergency.

Frank G. Steinebach

Editor

THE FOUNDRY—WHEREVER METALS ARE CAST

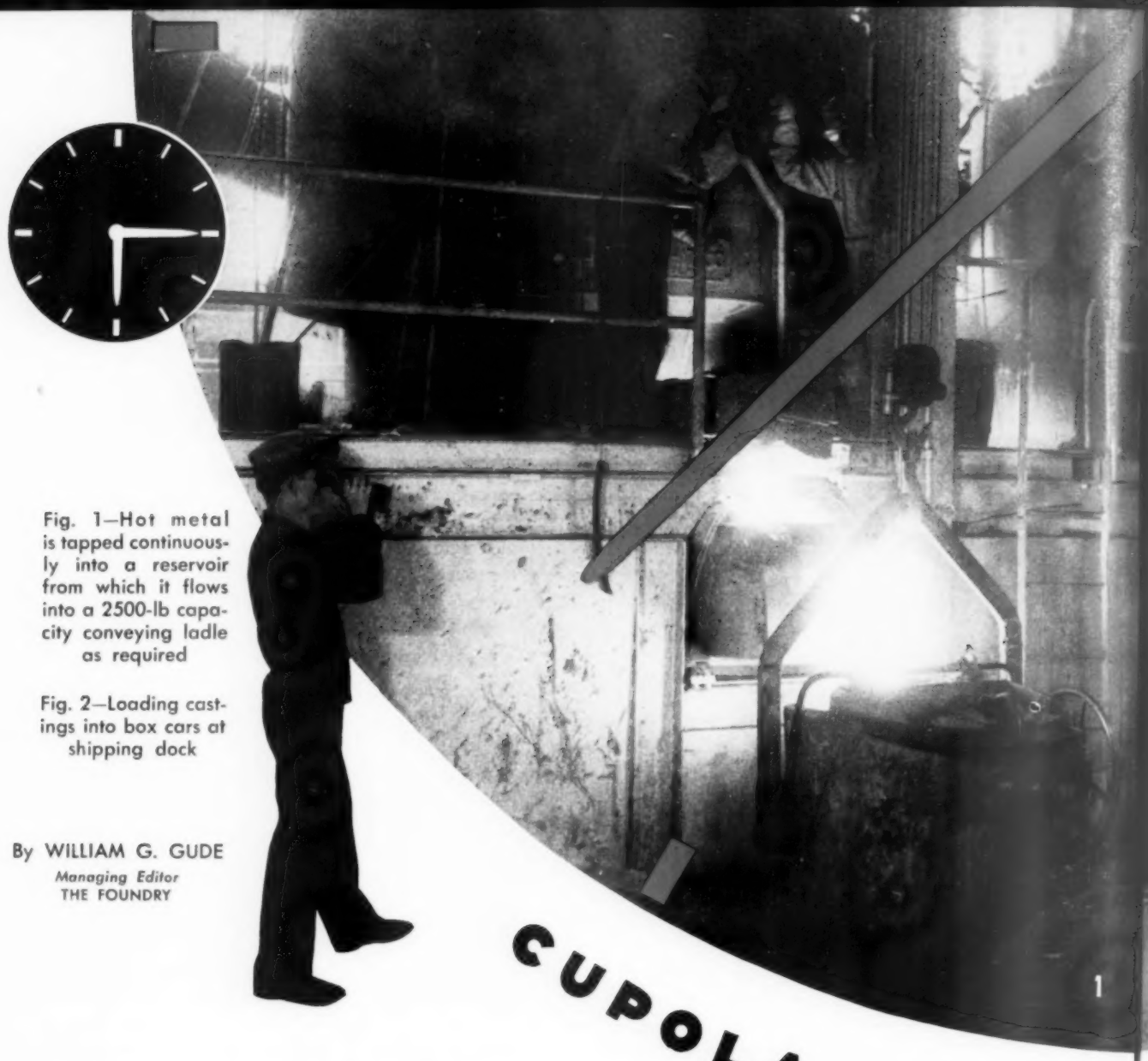


Fig. 1—Hot metal is tapped continuously into a reservoir from which it flows into a 2500-lb capacity conveying ladle as required

Fig. 2—Loading castings into box cars at shipping dock

CUPOLA SPOUT TO SHIPPING DOCK —in 75

By WILLIAM G. GUDE
Managing Editor
THE FOUNDRY

PROBABLY the simplest way to define the extent to which mechanized operations and high-production equipment are employed in the new gray iron foundry of the Wheland Co., Chattanooga, Tenn., is to state that only 1¼ hours or less is required for iron flowing from one of its cupola spouts to be transformed into a cleaned and inspected casting stacked for shipment in a box car at the shipping platform.

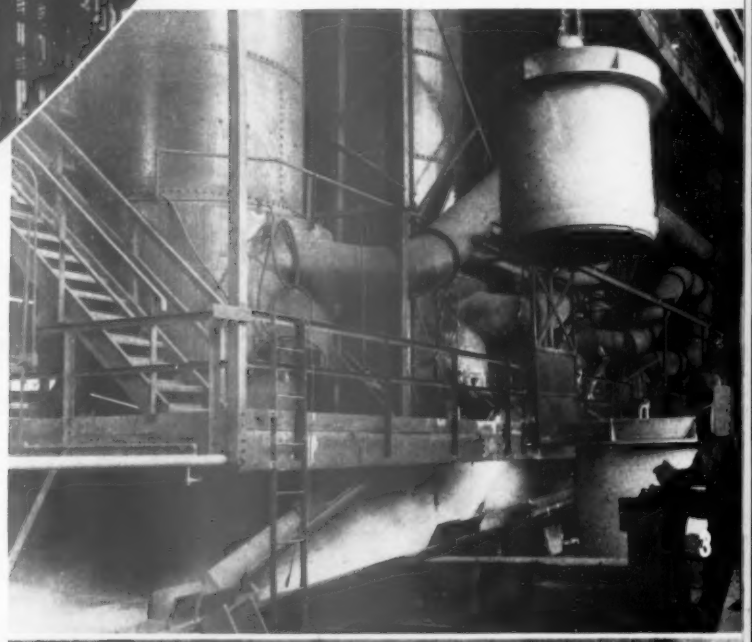
When the term "mechanization" is applied to a foundry it usually requires some qualification if it is to describe accurately the degree to which individual operations are performed mechanically, because the amount of mechanization which can be adopted varies according to the character of the plant. Obviously, the production type foundries—particularly those having continuous runs on relatively few types of castings—are in a position to effect greater mechanization than are the jobbing shops.

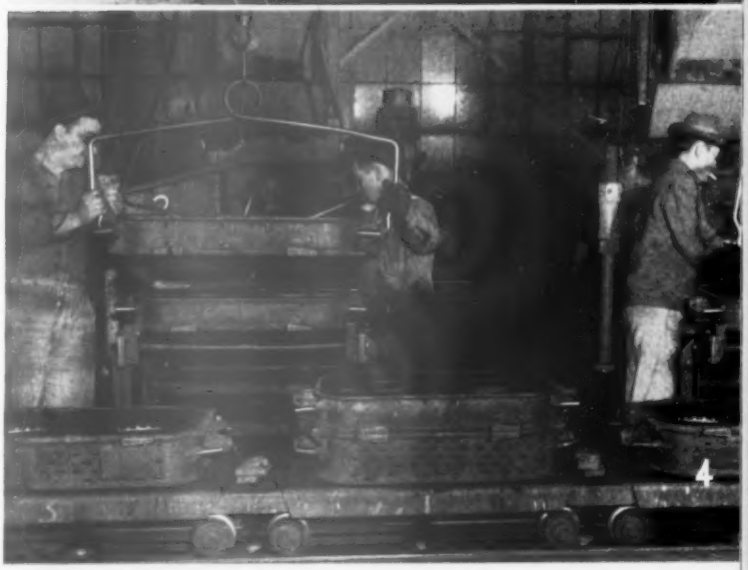
But while the Wheland Co.'s production falls in the classification of repetitious work on a few varieties of castings, the manner in which molding, melting, pouring and cleaning have been meshed to provide a smooth-running overall operation attests to the considerable amount of design and supervisory skill which has made this plant's high production possible. At the same time, the casual observer gains the impression that the good working conditions provided by the well lighted and well ventilated modern plant, plus a high worker morale, have something to do with what success has been achieved in production.

The Wheland Co. is one of the oldest manufacturers of the South. Established in 1866, it is well known as a builder of oil well drilling and pumping equipment and saw mill machinery. For many years the company has operated a jobbing type gray iron foundry for the production of castings required in

Fig. 3 — Charging side of the rear-slagging cupolas. Car at right collects charges in buckets which are lifted by overhead crane to charging door

Fig. 4 — Removing a cope from a molding machine preparatory to closing a mold on car type conveyor





...TO BOX CAR

...5 minutes

its manufacturing division. This older foundry, occupying a separate building, still is operated. During the recent war the company undertook the production of 90-mm guns for the government, and for this work a new building was erected. Conclusion of the war left this building idle but it proved adaptable to castings manufacture when the company decided to engage in production foundry work. Except for foundation supports required for certain of the foundry equipment that was installed, relatively few structural changes were necessary when the building was turned over to foundry operations.

Production of castings was started early last year,

Fig. 5—Filling a flask with sand from overhead hopper at one of the molding stations
Fig. 6—Pouring brake drum castings as molds travel on conveyor
Fig. 7—Brake drums being removed from shakeout grid and hung on casting conveyor hook. A powerful exhaust effectively controls dust and fumes
Fig. 8—Another view of one of the casting shakeouts. The conveyor ascends sharply after leaving the shakeout, moving hot castings above floor level
Fig. 9—Sketch showing arrangement of two of the three molding loops at the Wheland Co. production foundry. Molds are poured at left, shaken out at right. Sand preparation equipment is in center
Fig. 10—View from one end of main foundry bay. Inclined belt at center returns sand from shakeouts to preparation unit. Note casting conveyor near ceiling

and since February, 1947, the plant has operated two 8-hour shifts daily, melting approximately 27[illegible] tons of iron a day. Output to date has consisted largely of automotive brake drums, made in three sizes, and automotive clutch housings for passenger cars and trucks.

The foundry comprises two structures—the main one, measuring about 120 x 500 ft, housing the molding, sand preparation, pouring and shakeout operations, while cleaning is conducted in a 100 x 200-ft connecting wing. The former unit, an interior view from one end of which is shown in Fig. 10, incorporates sand preparation and casting conveyor facilities in the main bay, with molding stations and mold conveyor loops located in the two side bays.

The sketch of Fig. 9 illustrates the general layout of the two lines shown partially in Fig. 10. One

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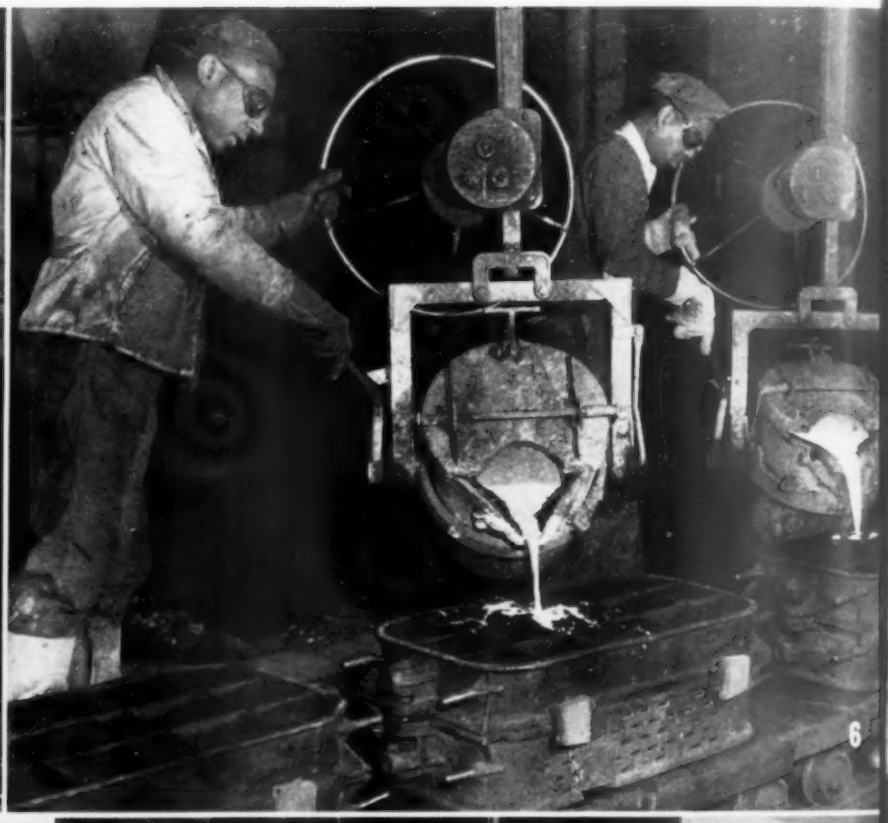
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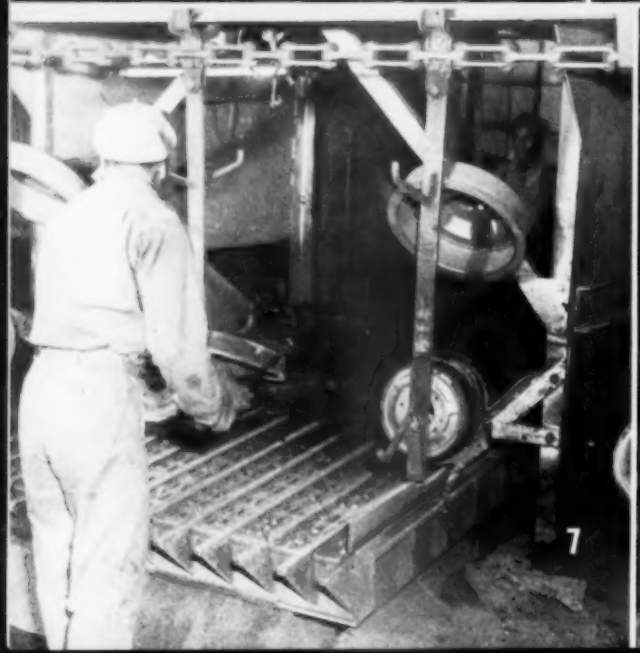
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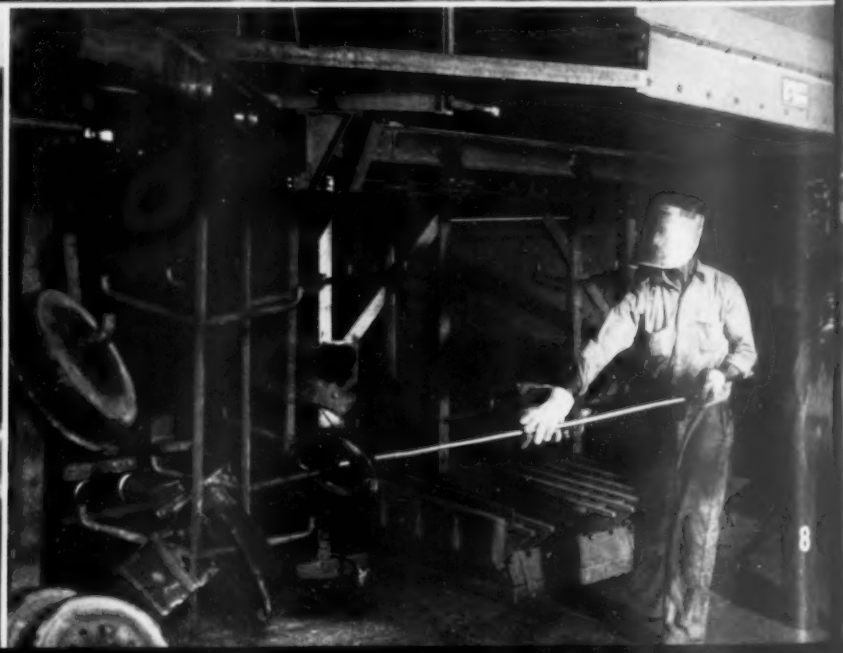
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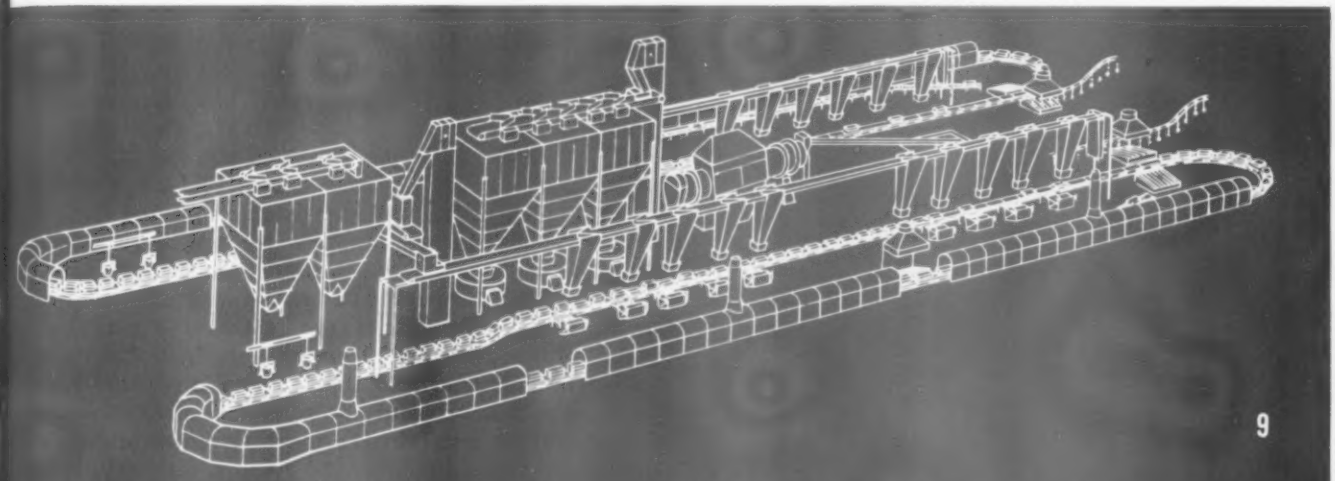
central sand preparation and distribution system serves both lines. This entire unit is largely duplicated at the opposite end of the building, except that so far only one conveyor loop and battery of molding stations has been installed. Clutch housings and truck brake drums are produced on this second unit. The melting department is conveniently located to the side between the two units.

Overhead trolley conveyor lines, shown at the extreme right in Fig. 9 leading from the shakeouts, comprise the connecting link between castings production, cleaning and shipment. These lines, with a total length of about 3000 ft, actually consist of one continuous line which serves all of the various mold loops. It extends from the shakeouts to the cleaning and inspection departments and finally to the shipping dock.

Brake drums are made in three sizes ranging up to 16 in. in diameter and up to 52 lb in weight. Maximum weight of the clutch housings is about 40 lb. Both the drums and housings are cast two per mold.

Each of the two brake drum loops, which extend 209 ft between centers, operates ten jolt-squeeze, strip molding machines—four producing copes and four drags, with the additional pair of machines available as spares. Molding stations are supplied sand from individual overhead hoppers, and molds are set out on a power conveyor by hoists. After the drags are molded, and before they reach the cope stations, the brake drum webs and a strainer core are placed in the molds. These webs or inserts—consisting of steel stampings suitably formed to permit incorporation of the drum in the brake assembly



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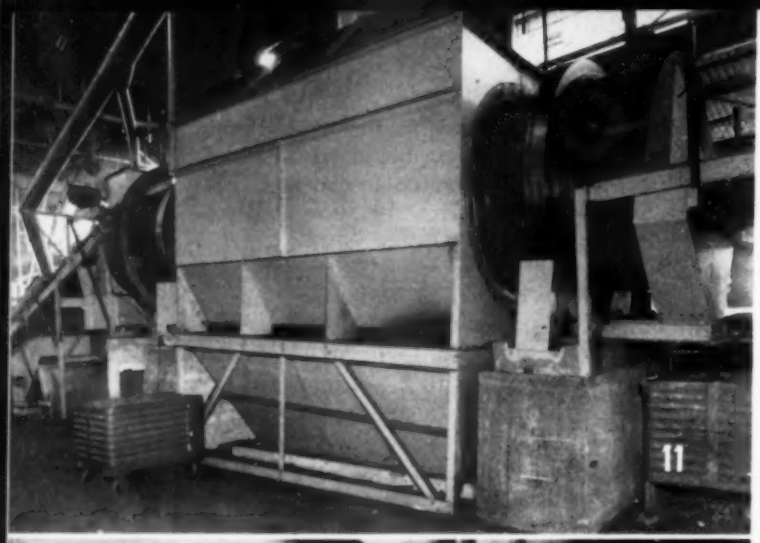
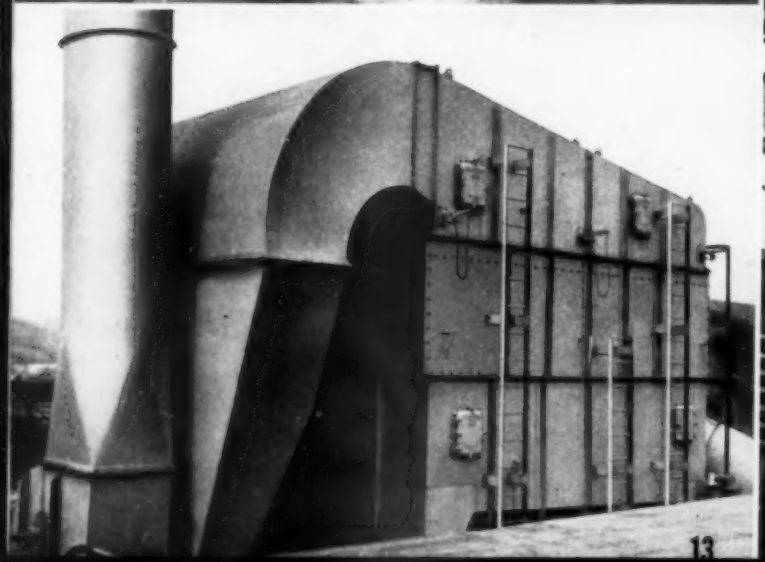




—fuse with the drum itself when the casting is poured.

A close-up view showing how the web is mated with the drum is provided by Fig. 7, while Fig. 14 shows how the webs are first degreased and preheated. The webs are placed in the drag accurately and quickly by means of a hand-operated device which picks up two of the inserts at a time from stacked piles. Pins on this device match the flask bushings and permit the operator to locate the webs properly in the mold before he releases them.

Fig. 4, a view of two of the cope molding stations, shows a cope being removed from a machine preparatory to being placed on a drag. As indicated, barred flasks incorporating four locking wedges on the sides are employed. After the closed molds are clamped they reach the pouring stations located at the left end of the two loops shown in Fig. 9. Hot metal is carried by monorail hoist from the cupola in 2500-lb capacity tapping ladles and transferred to 400-lb pouring ladles. The latter, such as illustrated in Fig. 6, move over monorails along the mold conveyor line. The iron is poured at about 2650° F. Immediately after pouring, the mold train enters a tunnel equipped with an exhaust to remove smoke and gases.

Molds are relatively cool by the time they arrive at a station where the cope is removed and shaken out. The drag then proceeds to another shakeout station, two views of which are shown in Figs. 7 and 8. Castings move forward on the inclined vibrating grid, while drag flasks are vibrated on another grid to the rear and then are placed on a roller conveyor for return to the molding stations. Dust and gases generated at the shakeouts are prevented from drifting out into the plant by an effective exhaust system—as evidenced by the accompanying illustrations. Each shakeout is exhausted at the rate of 12,000 cfm.

A monorail trolley conveyor passes its "Christmas-tree" type carriers over the shakeout grid, and an operator, with considerable dexterity born of practice deftly slips the castings onto the carrier hooks. Most gates and runners are broken off the castings by the shakeout vibration and are collected as they fall from the screen.

A simple but effective (*Please turn to page* 134)

Fig. 11—Revolving cooler screen into which sand from shakeouts is deposited by belt conveyor

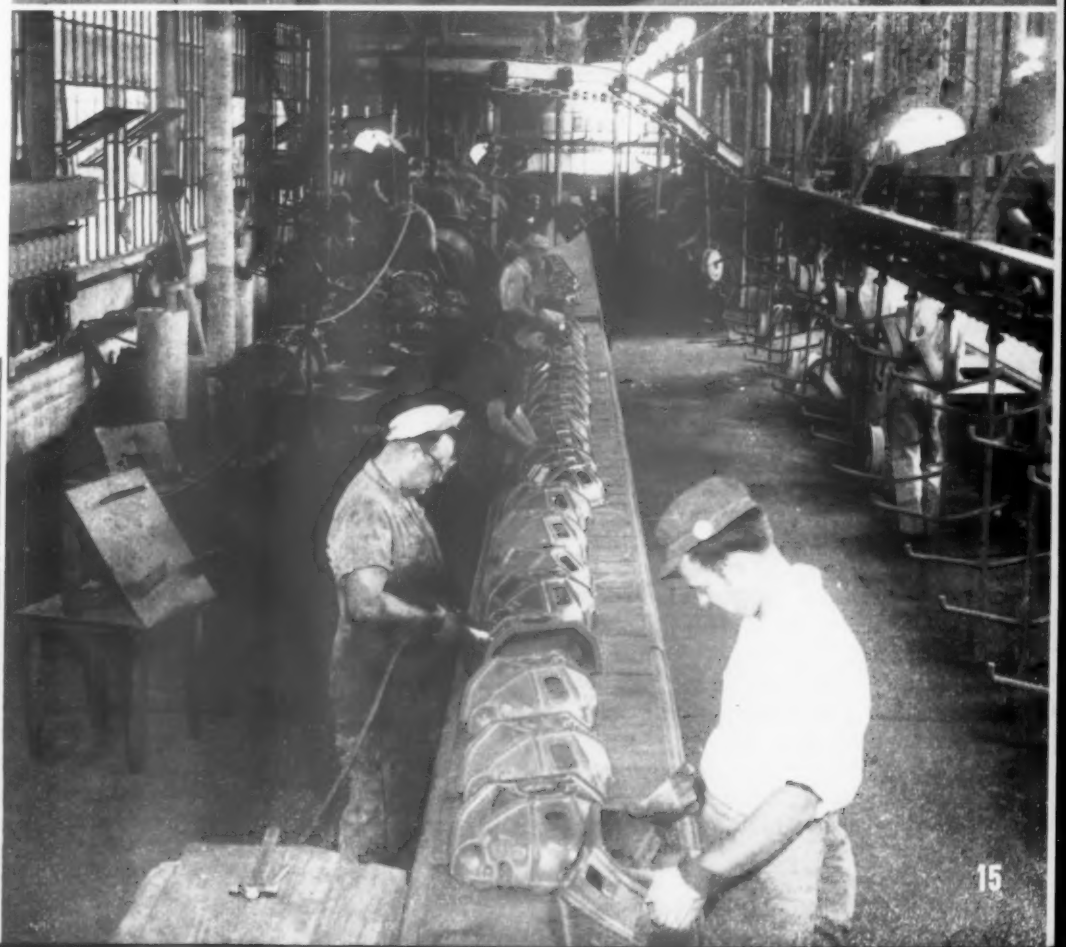
Fig. 12—Each of three mixers for preparing molding sand handles 2500-lb batches

Fig. 13—Central dust collection unit mounted on plant roof

Fig. 14 — Degreasing and preheating brake drum inserts

Fig. 15 — Chipping, grinding and inspection of clutch housings after tumbling

Fig. 16—One of the shot blast tables for cleaning brake drum castings



SOLVED AND UNSOLVED PROBLEMS IN

Blackheart Malleable

This paper comprises the 1948 Edward Williams Lecture of the Institute of British Foundrymen which was delivered for the author at the 45th annual conference of the institute in London, June 9.

WHEN YOU honor a speaker with an invitation to deliver such an address as this you no doubt expect that he should deal with a field with which he has had more than transitory contact. Some 45 years' connection with the manufacture of American or blackheart malleable have prompted the selection of the present subject.

There is, perhaps, some historical justification for the address to a British audience on the subject of blackheart malleable by one long associated with National Malleable & Steel Castings Co. The introduction of blackheart malleable into Britain was largely the result of collaboration, perhaps 60 years ago, between Sir Francis Ley of Derby and Alfred Atmore Pope, long president of National and of some of its corporate predecessors.

You have apparently been more interested in whiteheart malleable than in blackheart. Whiteheart malleable has no commercial significance in America, even though we produce about one million tons of blackheart malleable a year. Lately your literature reports work very pertinent to our problems. Much of this emanates from your Cast Iron Research Association. Since we are concerned with the control of decarburization while you have mostly been interested in its promotion, we find much novelty in what Jenkins and others have done in England in this field.

You will, no doubt, have inferred from this introduction that your speaker's interest is much more with regard to metallurgical principles than in the details of plant operation or equipment.

The ultimate object of the American industry is to produce metal of the quality required by the ASTM specifications for tensile strength which shall be machinable at high cutting speeds and which can be produced by the most economical methods. Obviously some compromise may be required. In addition to cupola malleable and the pearlitic type, the ASTM recognizes two grades of malleable iron. These are designated by code numbers 32510 and 35018, respectively. The first three figures indicate the yield strength (in hundreds of pounds per square inch); the last two figures indicate the elongation. The two grades are required to have tensile strengths of 50,000 psi and 53,000 psi, respectively.

These numbers are, unfortunately, not the result of well founded research but represent really a consensus of well informed opinion. It is well known that there are considerable variations in tensile strength corresponding to a given yield strength and also in the tensile strength-elongation relation. Since the American product is, in general, almost completely free from combined carbon, and since the yield ratios do not seem related in any way to composition, this represents the first unsolved problem. One may wish to consider that up to the yield point the deformation is largely elastic and a change of volume may be occurring whereas between the yield strength and the tensile strength the deformation is largely plastic and unaccompanied by a change of volume.

Ductility Varies With Graphite Size

A second unsolved problem is the observed fact that metal containing a considerable amount of pearlite varies considerably in elongation for similar amounts of combined carbon. In this connection one is left to consider the effects of decarburization of surface metal on the apparent ductility of the alloy.

The form of the graphite aggregate, a field in which Morrogh's work may be a most important guide, may also be of importance in explaining the foregoing anomalies.

It is surprising, but probably well established, that malleable iron whose graphite is in relatively few large nodules, is more ductile than the identical metal so treated as to contain perhaps one thousand times as many nodules, and quite dense ones at that.

It is entirely plausible that the tensile strength of malleable should be a function of the amount of graphite present. Yet the change in tensile strength produced by small changes in graphite content in the general region of 2½ per cent carbon may be at the rate of 12,000 psi per 1 per cent carbon in some operations and 29,000 psi in others. Originally we

THE METALLURGY OF

By DR. HARRY A. SCHWARTZ
Manager of Research
National Malleable & Steel Castings Co.
Cleveland

were satisfied with the gross conclusion that there was a direct relation. Now we must seek an explanation of the quantitative differences.

The effect of graphite on the modulus of elasticity of malleable iron is almost exactly in proportion to the amount present. The correlation of this modulus with density is of a very high order indeed. Again we may have a manifestation of the maintenance of constant volume for plastic deformation and an alteration of volume in the elastic range. Perhaps we should consider such effects, and hence a graphite form. A relation to form is plainly evidenced by the fact that the effect of a given amount of graphite in gray iron on the modulus of elasticity is very different from the effect of the same amount on malleable iron.

Study Effect of Elements

The effect of elements other than carbon upon the mechanical properties of completely ferritic malleable has at last been brought into some kind of order. In blackheart malleable the sulphur is all present in combination with manganese. It is difficult to obtain any large mass of data which may be supposed to represent a single universe for statistical study of the effect of manganese-sulphide. By selection of some appropriate groups, however, and intercomparison, it has been shown that, volume for volume, manganese sulphide affects the properties by something of the same order of magnitude as graphite.

Statistical studies as to the effect of manganese, chromium, silicon and phosphorus have been made based on thousands of analyses. One actually determines, of course, the rate of change of strength with concentration. Extrapolation to pure iron yields impossible values. Furthermore, the effect of silicon as determined by these statistics is a decrease in tensile strength, a result not to be anticipated from the solution of an element in ferrite.

Work on medium carbon normalized steels has finally unearthed a systematic treatment of the fact that the effect of a given change of concentration of a specific element depends upon the concentration of all the elements present. Empirically it is true that if the effects of all the elements present be summed up, assigning to each a potency which has been experimentally determined, then the actual tensile strength is a probability function of the number so obtained. This means that the effect of a given change of composition (*Please turn to page* 216)

DR. HARRY A. SCHWARTZ, author of the 1948 Edward Williams Lecture of the Institute of British Foundrymen, is widely known for his contributions to the field of research in malleable iron and for his numerous articles and papers prepared for technical societies and publications. Born in Kentucky in 1880, Dr. Schwartz was graduated from Rose Polytechnic Institute in 1901. He joined the National Malleable & Steel Castings Co. in 1902 at its Indianapolis plant where he served as draftsman, chemist, metallurgist and assistant superintendent. Since 1920 he has been manager of research for the company at Cleveland.

Dr. Schwartz has long been active on committees of the American Foundrymen's Association and was honored by that organization in 1931 by being presented the John A. Penton Gold Medal. He is currently a member of the AFA Technical Correlation Committee, Malleable Division Executive Committee and chairman of the Heat Transfer Committee. In 1939 he was awarded the E. J. Fox Gold Medal of the Institute of British Foundrymen. For many years Dr. Schwartz has been a member of the editorial advisory staff of THE FOUNDRY.

PRESSURE CASTING

Aluminum Matchplates

IN PLASTER MOLDS

STARTING point for making a pressure cast aluminum match plate in plaster is preferably a metal master pattern with a very smooth surface. Wood patterns sometimes are used, but they must be treated with water-resistant lacquer or varnish so that when plaster casts are subsequently made from the master pattern the wood will not swell and cause difficulty in molding as well as dimensional inaccuracies. In a properly cast plate made from a wood pattern the grain of the wood will be clearly reproduced unless the surface of the wood has been filled, varnished and rubbed down carefully. Wood patterns with thin structures give more trouble in molding than ones with a more massive structure.

Assume that we are to make a pressure cast plate for use with 10 x 14-in. flasks containing six patterns, each corresponding to the drawing shown in Fig. 1. Also assume that we have one white metal master pattern made to the correct shrinkage, which in this case would be the shrinkage of the metal in which the part eventually is to be made plus the shrinkage for the aluminum in the pressure cast plate.

The first step is to determine how the patterns are to be arranged on the plate, making due allowances for gates and risers. Assume that we are not going to cast the gates or risers integral with the plate but will add these items later. The arrangement chosen for making this particular plate is given in Fig. 2. Subsequently, we shall make plaster blocks which will be arranged as indicated by the dotted lines. It is only by this preliminary arranging that we can determine the size of these blocks.

Having arrived at the size of the blocks needed, it is now necessary to make a split frame corresponding to this size. A convenient construction is shown in Fig. 3. In addition to showing the construction of the split frame these views also show the master pattern in place upon the initial match, which in this case is made up of wood and modeling clay as shown, and could be called the temporary match. Notice that there is a plastilene or modeling clay extension of the pattern to the top of the wood frame; this is to provide a knock-out hole for removing the pattern from the subsequent hard plaster cast made from the temporary match.

The split frame should be shellacked (on the inside and edges only) as well as the top surface of the match and allowed to dry. Then the inside of the frame and the match surface is lubricated with a thin film of pattern lubricator, such as listed in the appendix — except graphite and oil. However, a rather thick coating of graphite and oil (not too much oil) should be applied to the vertical and inclined surfaces of the master pattern.

A hard plaster mixture is now poured in the cavity over the match so that an excess remains above the top surface of the wood frame. When the plaster starts to set it is struck off level with a metal straight edge. A good plaster for use in making such a permanent match is a dense, low expansion, low absorption material designed for production of accurate models, and is so mixed that the weight of water used equals 42 per cent of the weight of plaster. (Editors' note: A pint of water weighs 1.04 lb). If mixing by hand add the plaster rather slowly to the water and allow to soak two or three minutes

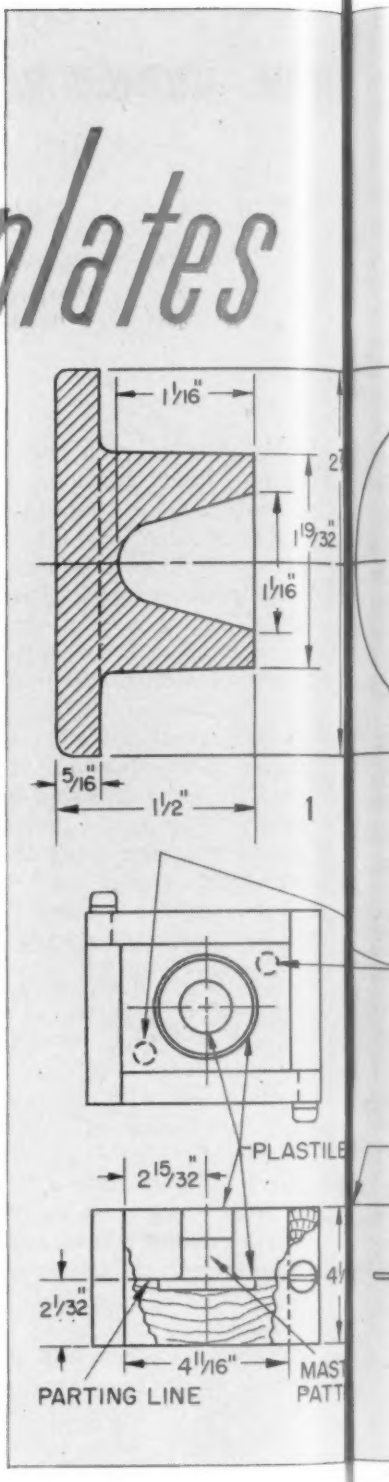


Fig. 1—Drawing of casting for which matchplate is to be made

Fig. 2 — Arrangement selected for six patterns on the plate

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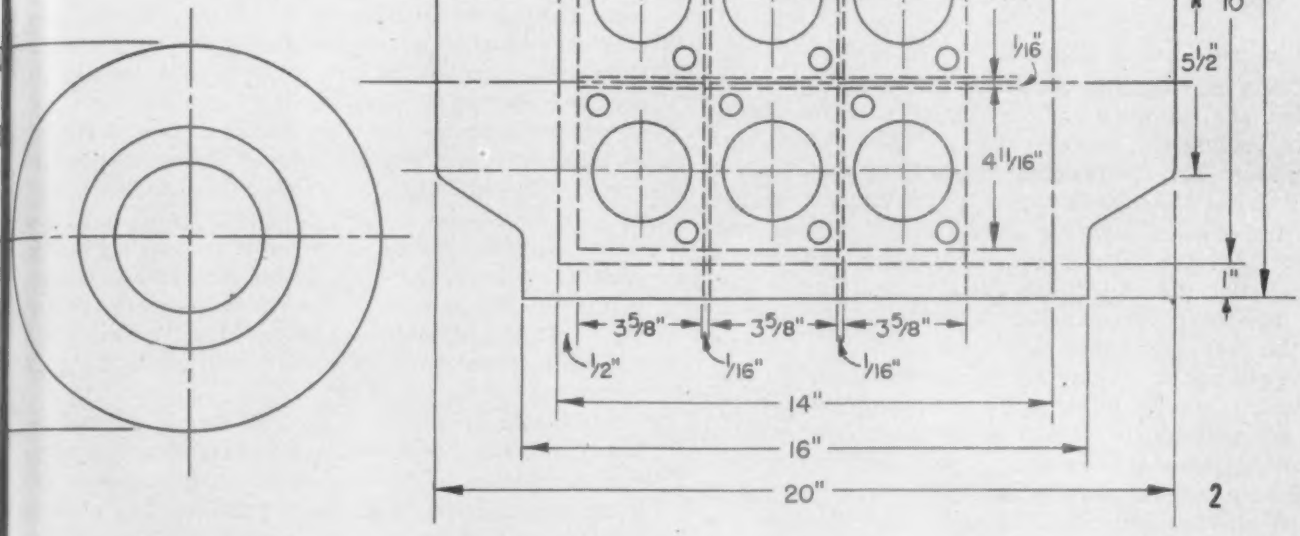
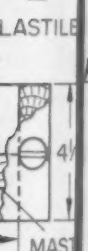




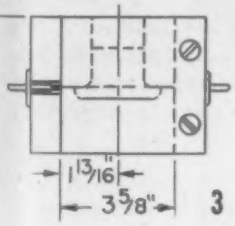


Fig. 3—Split frame for plaster blocks with master pattern in place on temporary match

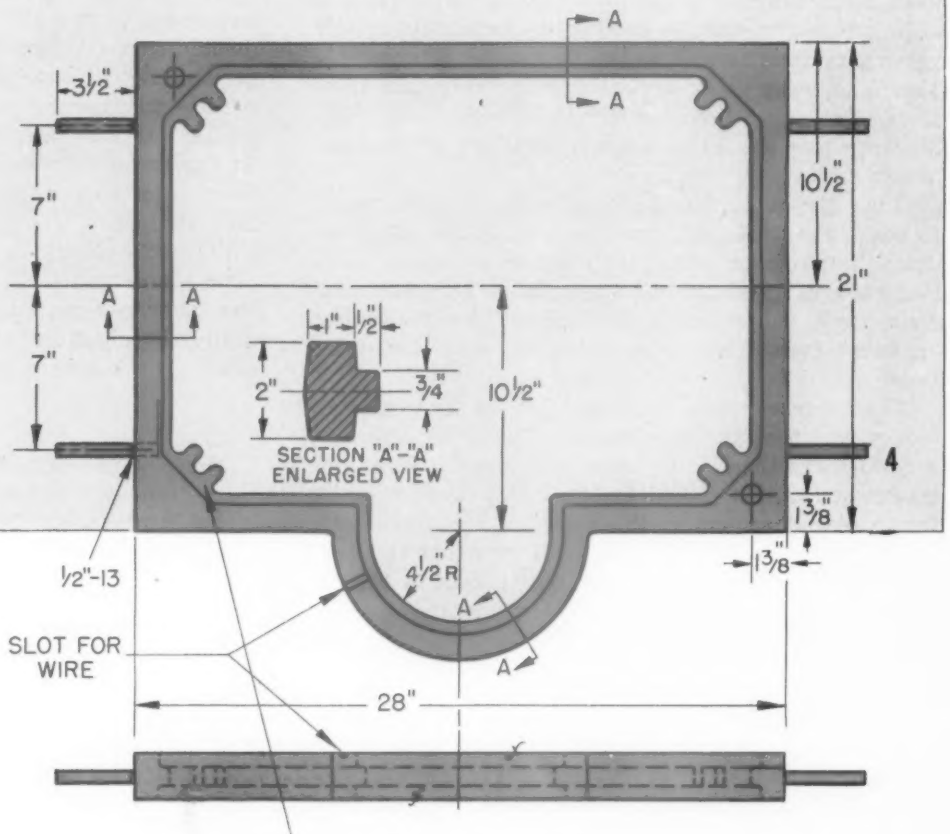


Fig. 4—Cope or drag frame into which plaster blocks are cast

NOTE: USE THESE LUGS FOR CLAMPING TWO OR MORE FRAMES TOGETHER

before mixing. Mix until free of lumps. The weight of plaster needed for a given mold cavity can be found approximately by the following formula:

$$(1)\ \text{Pounds of Dry Plaster Required} = \frac{\text{cu in. in cavity}}{20}$$

In the present case (not considering the volume occupied by the pattern) the plaster required would be:

$$\text{Weight} = \frac{3\frac{5}{8}'' \times 4\ 11/16'' \times 2''}{20} = 1.7 \text{ lb.}$$

Water required = $.42 \times 1.7 = .71\frac{1}{2}$ lb.

The next step is to carefully remove the split wood frame and the wood and clay match from the plaster cast, leaving the master pattern in place. Now with hand tools and fine sandpaper smooth up the match so that it exactly coincides with the parting line desired on the master pattern. Now remove master pattern from the plaster cast by tapping out with a wood stick placed through the open hole in the back of the cast. The impression of the master pattern in the cast should then be sanded out so that the pattern will not stick even though all the way in the cast.

It is necessary to cut sufficient plaster keys in the match so that the blocks to be made later will be properly doweled together. A key that has worked out very satisfactorily is one made with a standard wood countersink, cut to a depth such that the depression measures between ½ and ⅝-in. diameter at the parting line. Fig. 3 gives the location of the keys used in this match.

Now it is necessary to shellac the permanent match parting surface as well as the two dowel depressions. This is done by using several coats of very thin shellac and allowing time for drying between each coat. Shellac coats should be applied until the surface becomes glossy.

When the match is thoroughly dry we are ready to make the final casts used in making the cope and drag plate molds. The composition of these mold materials is given in the appendix and these materials shall subsequently be referred to as simply "plaster" even though containing the other listed ingredients.

We are now ready to make the six drag plaster blocks and the six cope blocks. The most accurate way to make these is in pairs, as follows: First the master pattern is placed in the match and the split frame placed around it the same as was done with the temporary match in Fig. 3. Notice that the pattern will be upside down from that shown in Fig. 3. The match, box and pattern are carefully lubricated as before except only a very minimum is used (no graphite and oil), making especially sure that lubricant does not build up in corners, etc., and thereby rounding off the corners of the mold.

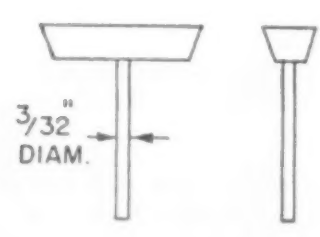
Sufficient quantity of plaster is mixed with water (see appendix for correct proportions of the various mixes) and poured into the cope mold similarly to the method used in making the previous cast. It might be mentioned here that in making plaster casts certain precautions are necessary in order to eliminate trapped air bubbles. First, do not whip bubbles in plaster during mixing; second, pour plaster in a slow, steady stream as far away from the pattern as possible; and third, after the mold is filled, the table on which the frame is setting should be tapped slightly, which should bring any trapped air bubbles to the surface. If difficulty still is experienced with trapped air bubbles it may be found helpful to apply a fine water spray to the mold just prior to pouring in the plaster; or brushing the plaster material over the surface of the pattern during pouring may be necessary. This last method has the disadvantage that lubricant is removed from the pattern according to the amount of the brushing.

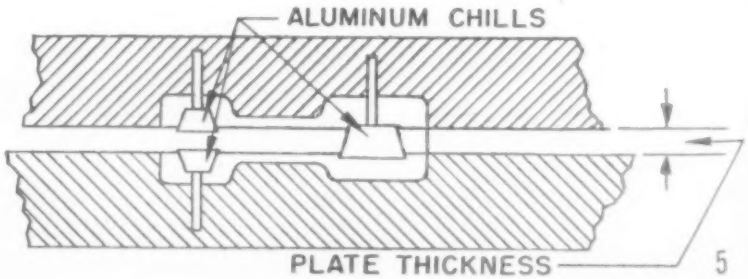
After this first mold is poured, struck off and allowed to set the frame and match are removed, leaving the pattern in the cope mold. High pressure air is helpful in separating plaster molds, the method being simply to apply the air nozzle at the parting line at various points on each side of the mold.

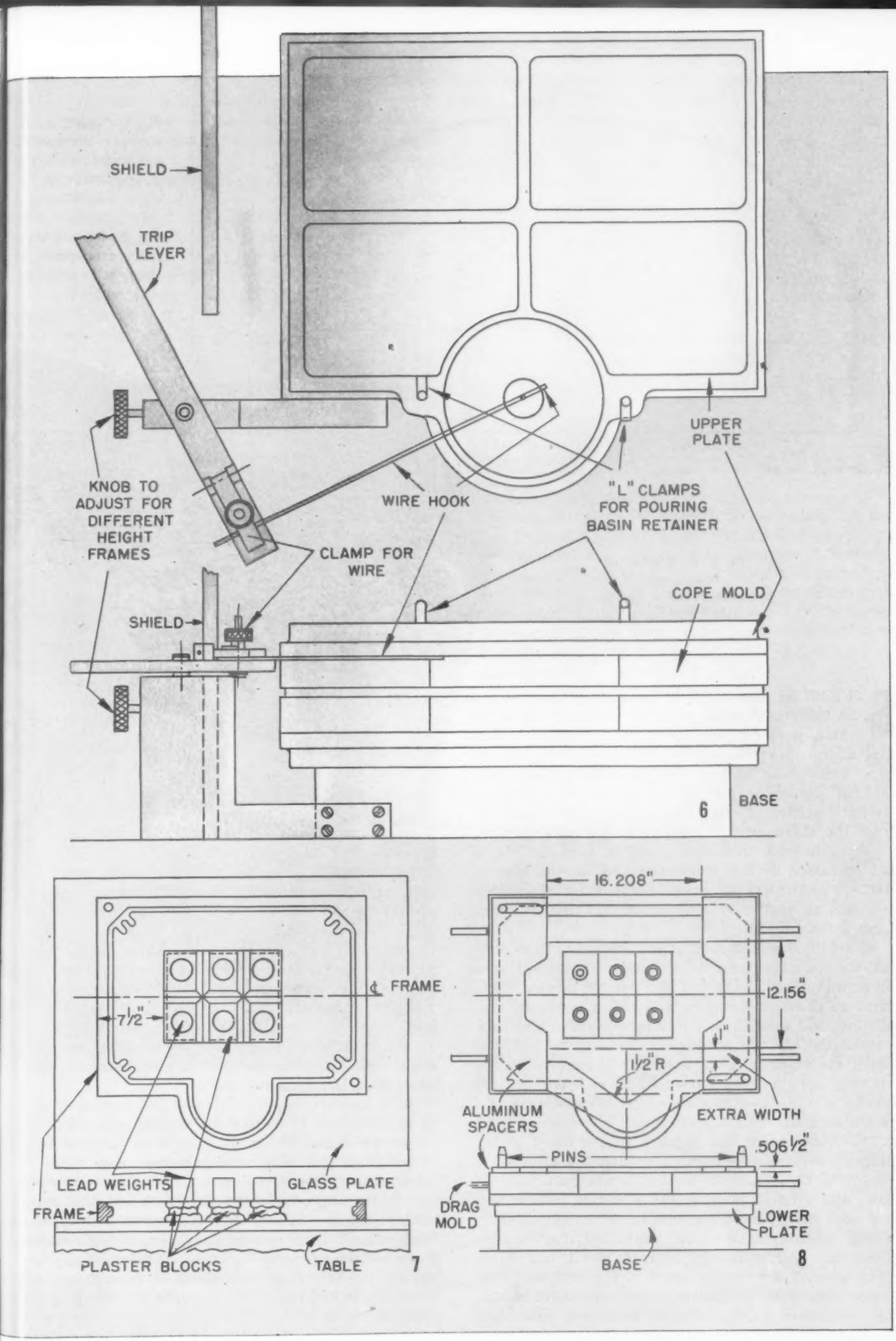
Now set the cope plaster cast with pattern side up and apply a separator for "green plaster" on the top plaster surface. Lubricate the pattern as was done for making the cope plaster cast. The test for determining whether or not sufficient green plaster separator has been applied is to place a drop of water on the treated surface. If the water remains in the form of a ball indefinitely, sufficient separator has been applied.

Place the frame around the green cope mold and pour the drag mold. These molds are separated, and the pattern removed. The latter operation is generally the most difficult and in this case was accomplished by inserting ma- (*Please turn to page* 194)

Fig. 5—Chills located in cavities in the mold corresponding to heavy sections of the pattern
Fig. 6—Assembly showing trip lever mechanism used to allow metal to enter the mold
Fig. 7—Edges of the six plaster blocks are beveled to allow them to knit together
Fig. 8—Aluminum spacers in place on parting surface of the drag mold






SHIELD
TRIP LEVER
KNOB TO ADJUST FOR DIFFERENT HEIGHT FRAMES
CLAMP FOR WIRE
WIRE HOOK
"L" CLAMPS FOR POURING BASIN RETAINER
UPPER PLATE
SHIELD
COPE MOLD
BASE
6
7½"
℄ FRAME
LEAD WEIGHTS
GLASS PLATE
FRAME
PLASTER BLOCKS
TABLE
7
16.208"
12.156"
1"
1½" R
ALUMINUM SPACERS
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DRAG MOLD
LOWER PLATE
BASE
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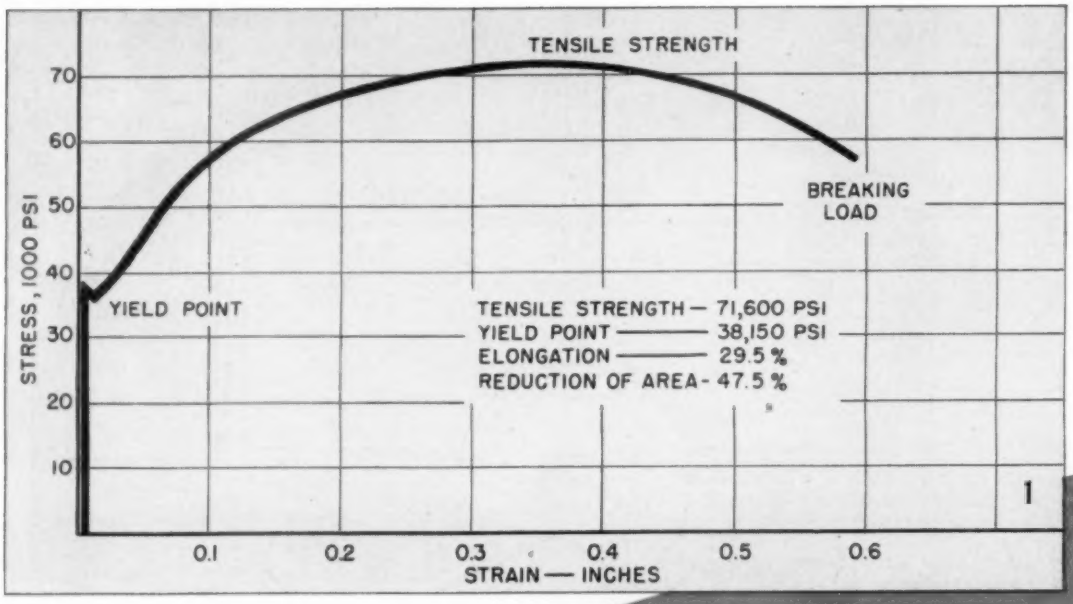

Fig. 1—Typical quantitative stress-strain curve for a ductile metal

Fig. 2—Typical physical properties of steel in notched tension

What is Strength?

By J. B. CAINE
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Lockland, O.

STRENGTH should be of paramount importance to the foundryman because, in the final analysis, it is his livelihood. Any casting or, for that matter, any structural member in itself is merely so much dead weight. Its only use is its ability to hold something up, or together. This service-strength ability is vitally important. Unfortunately, from the standpoint of simplicity this all-important property is hard to measure and to evaluate. It is not evaluated by any single test such as the tension test. Fundamentally, it is defined by the same criterion as quality—the cheapest part that will perform satisfactorily.

Although the definition of service strength is simple, its evaluation can be definitely established only by actually testing the full size part in service. This must be done on complete assemblies, made in production, and even then it is very expensive and time consuming. If the foundryman wishes to test and prove his castings, such a course is impossible and his only hope is to find tests which at least simulate service conditions—tests which from experience correlate with the behavior of metals in service.

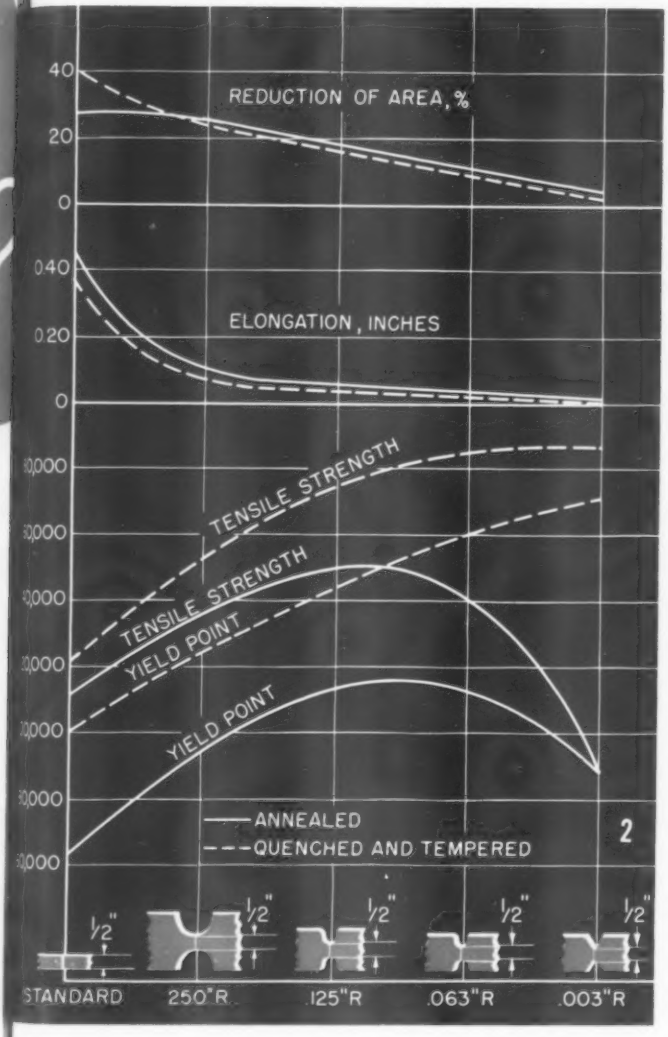
The foundryman has another vital interest in the property-service strength other than his interest in supplying the cheapest, most efficient part. In the past, and even at present, the standard tension test has been used almost universally as the standard by which metals have been evaluated for service strength. Unfortunately, a cast metal can never compete with a wrought metal so far as those properties measured in tension testing—so-called ductility, elongation and reduction of area—are concerned. Castings have suffered competitively in the past and are still at a disadvantage because of this fact.

However, so much evidence has accumulated during the last ten years lending doubt to tensile properties as an evaluation of service strength that the designer is starting to mistrust tensile properties. There have been too many instances reported where metals, whether they be cast or wrought, have failed in service, even though they have shown excellent tensile properties. It behooves the foundryman to be well acquainted with this situation, as castings show up much better competitively in some of the newer tests that seem to evaluate service strength better than does the tension test.

It is an unfortunate failing of the human mind to take for granted familiar objects and behaviors. Because the standard tension test is so familiar to all those connected with metals it has been taken for granted and because it has, it is high time to re-examine it. Any test, when it becomes an accepted standard, as has the tension test, has two uses—evaluation and control. It is extremely important that these two uses be thought of as separate entities and any test, no matter how familiar, should be re-examined periodically to determine if its results are being applied properly.

A test may be perfectly satisfactory for control

purposes and at the same time be valueless for evaluation. All that is necessary in control is that the test show variations in the material, be reproducible, relatively cheap, easily made and nondestructive. At the same time the test may be useless for evaluation in not detecting material that will fail in service, because it is not measuring the desired property, or in rejecting material that is satisfactory for service because it is too sensitive, or measuring a property not utilized in service. It is imperative that an evaluation test or tests measure the ability of the material or structure to withstand service stresses regardless of the time or cost of the tests. Otherwise all time and money spent in testing is wasted. Of course, it



would be nice if one simple test would combine all of these requirements. Unfortunately, none is known. All that can be hoped for is to apply correctly, knowledge gained from elaborate destructive evaluation tests to simpler nondestructive control tests.

Let us examine the standard tension test to see how it fits the preceding conditions. The familiar tensile stress-strain curve for a steel is shown in Fig. 1, with something added—numbers. Perhaps some of the confusion existing in the evaluation of tensile properties lies in the fact that most published stress-strain curves are qualitative and simply show stress and strain with an arrow indicating increasing values. On a quantitative basis it becomes immediately apparent how far apart are the various properties determined—yield strength, tensile strength, elongation and reduction of area.

The most important property from the service standpoint is yield point, or yield strength. Since the amount of strain (elongation) is measured in ten thousandths of an inch, the amount of strain is so small that it cannot be shown accurately on a chart such as this. The slope of the line up to the yield point measures another important tensile property from the standpoint of design—modulus of elasticity, that property which controls the rigidity of the part in service. In service the load must be kept under the yield point if for no other reason than rigidity. If the part is loaded below the yield point all deformation is elastic, the amount depending on the modulus of elasticity of the particular metal used, and the part will assume its original dimensions when the load is released.

If the load exceeds the yield point, not only is the amount of deformation much greater, but the part has deformed plastically and will not assume its original dimensions. In machine design where there are moving parts the bearings will fail almost immediately if the yield point is exceeded. Even static structures such as bridges and buildings will be thrown so far out of line as to make them worthless unless stresses are kept below the yield point or yield strength of the materials used.

Evaluate by Three Other Properties

Nevertheless, metals are evaluated by three other tensile properties—tensile strength, elongation and reduction of area. Of the four commonly reported, yield strength is the easiest to meet and to control. The difficulty of meeting the other values increases in the order given. Modulus of elasticity is nonvariant for any given metal and because it is, is neglected too many times, frequently with embarrassing results. Castings can compete with wrought materials, their largest competitor, on an equal basis as far as yield strength, and modulus of elasticity are concerned, but have a harder time with the other three tensile properties. Castings and cast metals can never hope to compete on an equal basis using reduction of area as the evaluation. However, this property is not operative until both the yield strength is exceeded and the metal is stressed above its tensile strength, with the load dropping off as the cross section of the test specimen is reduced. This property is never operative in service, if for no other reason than because of the excessive amount of deformation that has taken place prior to the initiation of any appreciable amount of reduction of area. In the example given the deformation amounts to about 0.4-in. in 2 in., or 20 per cent. Any structure or machine would be worthless, even though in one piece, if it had undergone a deformation of 20 per cent.

The same reasoning holds true for the two other tensile properties used for evaluating metals. The ultimate or tensile strength is not reached in a ductile metal until extreme (*Please turn to page* 148)

STRESS CORROSION OF

Manganese Bronze Castings

By THOMAS L. SHEEHAN
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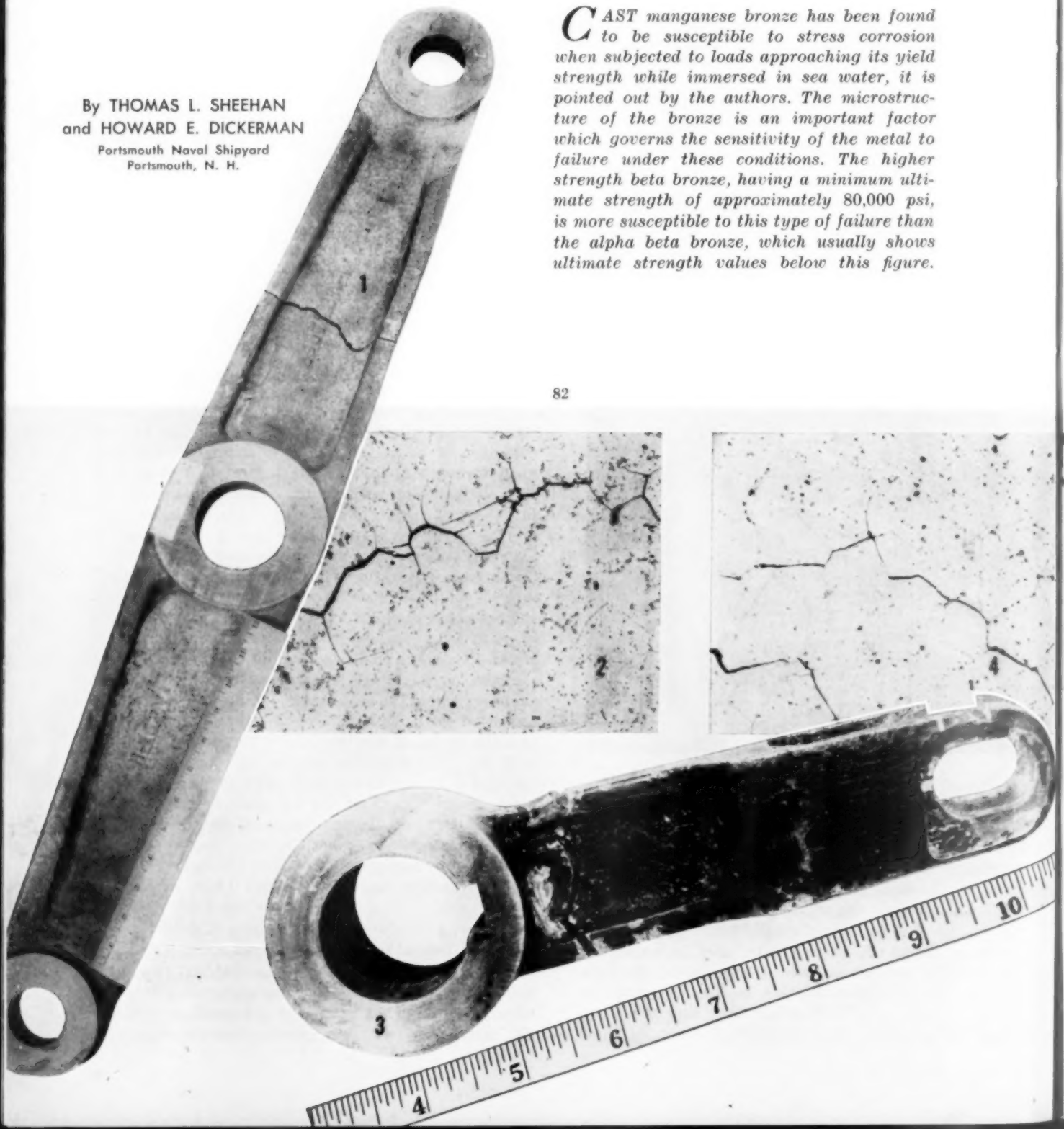
Portsmouth, N. H.

CAST manganese bronze has been found to be susceptible to stress corrosion when subjected to loads approaching its yield strength while immersed in sea water, it is pointed out by the authors. The microstructure of the bronze is an important factor which governs the sensitivity of the metal to failure under these conditions. The higher strength beta bronze, having a minimum ultimate strength of approximately 80,000 psi, is more susceptible to this type of failure than the alpha beta bronze, which usually shows ultimate strength values below this figure.



CAST manganese bronze is used extensively for marine parts requiring high strength and good resistance to corrosion in sea water. During World War II, it was used in large quantities as a substitute for nickel-copper alloy, which was difficult to procure because of critical shortages. At the Portsmouth Naval Shipyard, Portsmouth, N. H., hundreds of manganese bronze castings were manufactured for both inboard and outboard service where the requirements were such that high strength alone, or a combination of high strength and resistance to corrosion in sea water, had to be met. The general use of this alloy, however, was restricted when it was learned that many castings employed outboard in sea water had failed. Its use became limited to castings for inboard service, and to certain castings for outboard service which were not required to carry critical loads.

During the last three years, approximately 20 broken manganese bronze castings were brought to the authors' attention. These failures were encountered in various submarines during overhaul at the shipyard and were submitted to the laboratory for examination. In the beginning, it appeared highly significant that all of the failures had occurred in castings which operated in sea water and that none had been reported for castings of similar material and design operated inboard.

Metallographic examination and chemical analysis of each failure disclosed that the composition was such that the components' zinc and aluminum were present in sufficient quantities to produce complete beta microstructures. Examination further revealed that all of the failures occurred in a brittle manner, without any indication of the part bending or stretching, and that the path of the cracks followed the grain boundaries.

The results of these early investigations led us to believe that this type of failure was due to the simultaneous action of stress and sea water on beta bronzes only, and that manganese bronze of alpha beta microstructure was not affected by these conditions. Guided by this opinion, control methods were devised in the melting room of the shipyard foundry to limit the composition of the alloy to a desired chemical analysis of approximately 58 per cent Cu, 39 per cent Zn, 0.80 per cent Al, 1 per cent Mn and 1.2 per cent Fe. This analysis conforms to the Navy Department Specification 49B3f which gives the following limits: Cu 55-60 per cent, Pb 0.40 per cent max, Al 0.50-1.50 per cent, Mn 1.50 per cent max, Fe 0.40-2.00 per cent, Sn 1.00 per cent max, Zn remainder.

Many of our manganese bronze castings were supplied by commercial foundries, and one supplier was using ingot metal containing aluminum on the high side of the specification limit for that element. Some heats were barely within the 1.50 per cent maximum allowed, others contained up to 2.00 per cent, and with a zinc content ranging from 37 to 39 per cent, the microstructures were entirely beta. A typical analysis of this foundry's castings was: Cu 58.40 per cent, Al 1.54 per cent, Fe 1.29 per cent, Mn 0.36 per cent, Zn 38.41 per cent, and Sn trace. This analysis, although it is within limits of Navy Department Specification 49B3f, except for an excess of .04 per cent Al, produces a beta microstructure.

In the light of our past experience, the shipyard planning department prohibited the use of such material for outboard service on the basis of its microstructure, and the supplier was requested to change the composition of his metal to conform to the desired analysis as stipulated by this shipyard.

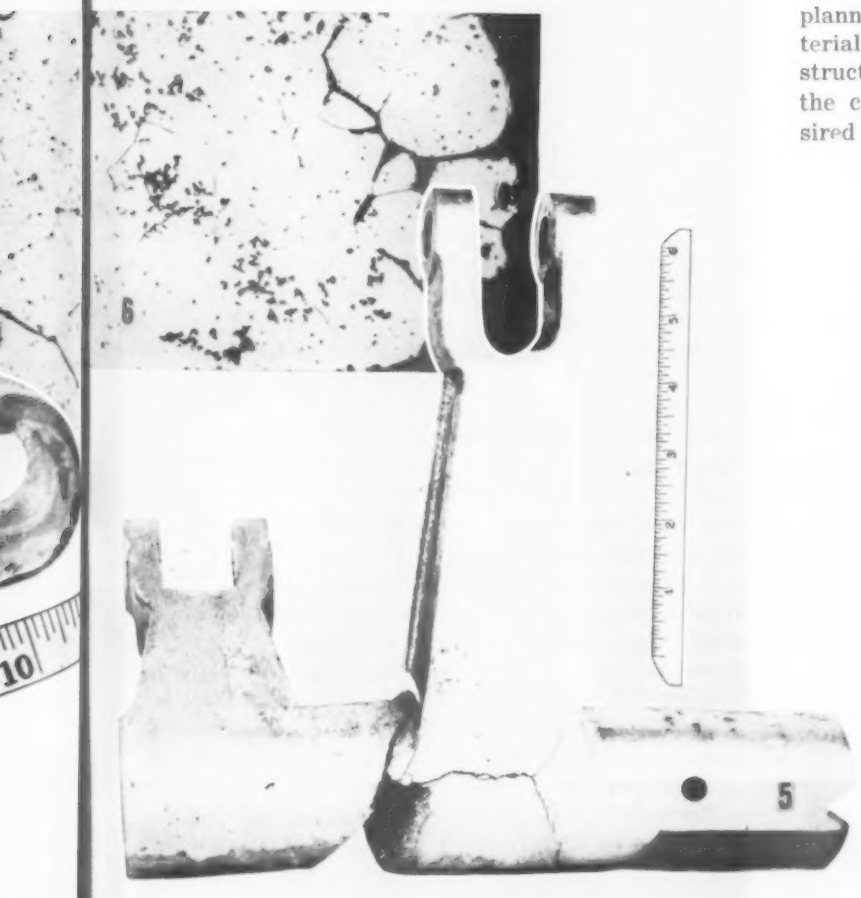


Fig. 1—Rocker arm which failed in service due to stress corrosion in sea water. Chemical analysis: Cu 56.61 per cent, Al 1.91 per cent, Fe 1.16 per cent, Mn 1.70 per cent, Zn 38.62 per cent

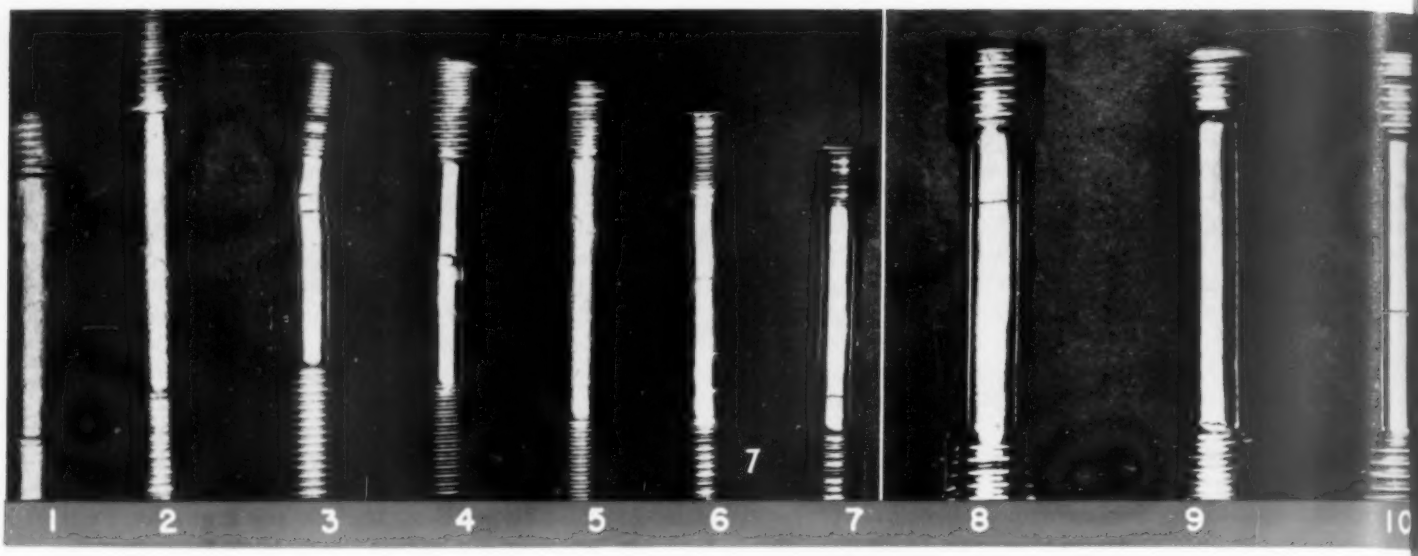
Fig. 2—Photomicrograph (X50) illustrating intercrystalline crack in beta microstructure of rocker arm

Fig. 3—Lever arm which failed in service due to stress corrosion in sea water. Chemical analysis: Cu 54.68 per cent, Al 0.78 per cent, Fe 1.15 per cent, Mn 1.60 per cent, Zn 41.79 per cent

Fig. 4—Photomicrograph (X50) illustrating intercrystalline crack in beta microstructure of lever arm

Fig. 5—Service failure of this bell crank also was caused by stress corrosion in sea water. Chemical analysis: Cu 55.87 per cent, Al 1.12 per cent, Fe 1.45 per cent, Mn 1.96 per cent, Zn 39.60 per cent

Fig. 6—Photomicrograph (X50) illustrating intercrystalline crack in beta microstructure of bell crank



Manganese Bronze Castings

Fig. 7, 8, 9—Beta specimens after failure
Fig. 10—Photomicrograph (X50) of specimen No. 14 illustrating an intercrystalline crack in a beta microstructure. This is typical of stress corrosion failures in sea water for all beta specimens
Fig. 11—Chrome-plated jig used independently of tension machine except for original loading

For several weeks castings were received, many of which could not be installed for sea water exposure on submarines because of the high aluminum-zinc ratio. When representatives of that foundry called at the shipyard for a conference on the subject, they were at a loss to understand why their castings having tensile values of 85,000 to 90,000 psi and elongations better than 20 per cent were not acceptable in view of the minimum requirements of 65,000 psi tensile strength and 20 per cent elongation as given in the specification. However, when they were shown some of the broken castings made from high-strength manganese bronze, they agreed to contact their ingot supplier to request a modification of chemical analysis of future shipments to comply with our specification.

In order to obtain further information the laboratory was requested by the shipyard planning department to investigate the factors related to these failures and to determine if a modified chemical analysis of manganese bronze would withstand submarine service conditions.

Before taking up the test work conducted in the laboratory to reproduce similar types of failures and to investigate stress corrosion in relation to lower strength alpha beta bronzes, it is considered timely to present a few illustrations of these failures, the microstructures involved and an explanation of the composition diagram related to the copper-zinc system.

Figs. 1 to 6 inclusive present illustrations in which the broken castings, their microstructures and chemical analyses are shown. Fig. 16 illustrates a typical stress corrosion fracture of beta bronze in which the geometric outline of the grain structure can be seen.

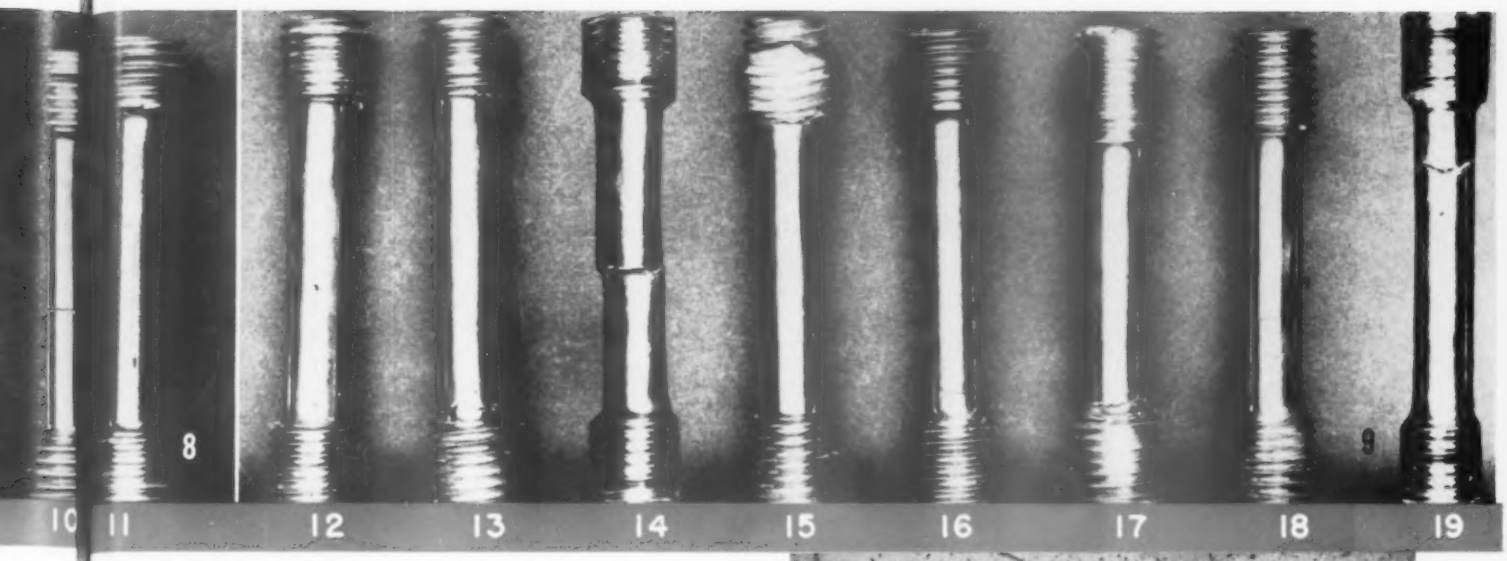
Fig. 12 is an equilibrium diagram of copper and zinc and indicates the combinations of these elements necessary to form various microstructures. The diagram shows that the alpha beta range, under equilibrium conditions, extends from 39 per cent to 46 per cent zinc, and the beta range extends from 46 per cent to 50 per cent zinc. However, since equilibrium is not attained in the usual casting procedure, a fairly rapid cooling rate of the molten metal in the mold has a tendency to shift the diagram to the left, thereby favoring the formation of a complete beta phase in borderline compositions.

Furthermore, aluminum added to a copper-zinc alloy is approximately six times as effective as zinc in advancing the microstructure to the right. To illustrate the latter, a 41 per cent zinc alloy is normally alpha beta, but with the addition of 1 per cent aluminum a zinc equivalent of 47 per cent zinc will result, and a beta microstructure is formed. The iron and manganese in the usual percentages found in manganese bronze have little or no effect on the microstructure in respect to the percentages of alpha or beta constituents.

Selection of Test Material — The sources of the specimens used in the test conducted in the laboratory are given in the following paragraphs, and chemical analyses of these heats are included in Table II (page 190).

Specimens numbered 1 to 7 inclusive (beta bronze) were obtained from a rocker arm casting which was sent to the laboratory for examination after it had failed in service. This casting, illustrated in Fig. 1, is used to support the muzzle door of a submarine torpedo tube. In service, it is totally submerged and under constant stress while maintaining the door in a closed position.

Specimens 8 to 11 inclusive were obtained from a special heat of manganese bronze cast in the Ports-



mouth Naval Shipyard foundry. This heat was prepared from a mixture calculated to produce a beta microstructure.

Specimens 12 to 19 inclusive were obtained from different heats of manganese bronze cast by a foundry under contract to the shipyard. The beta microstructures of the heats were detected by the laboratory in making routine checks on the chemical and physical properties of the castings.

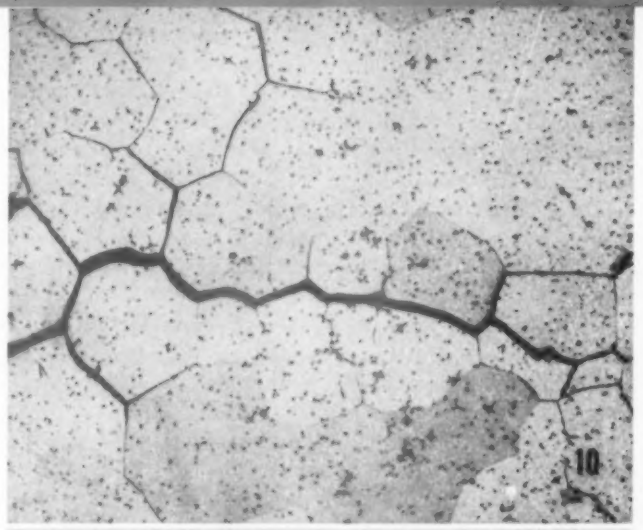
Specimens 20 to 24 inclusive were obtained from a special heat of manganese bronze cast in the Portsmouth Naval Shipyard foundry and were produced from a mixture which was calculated to give an alpha beta microstructure.

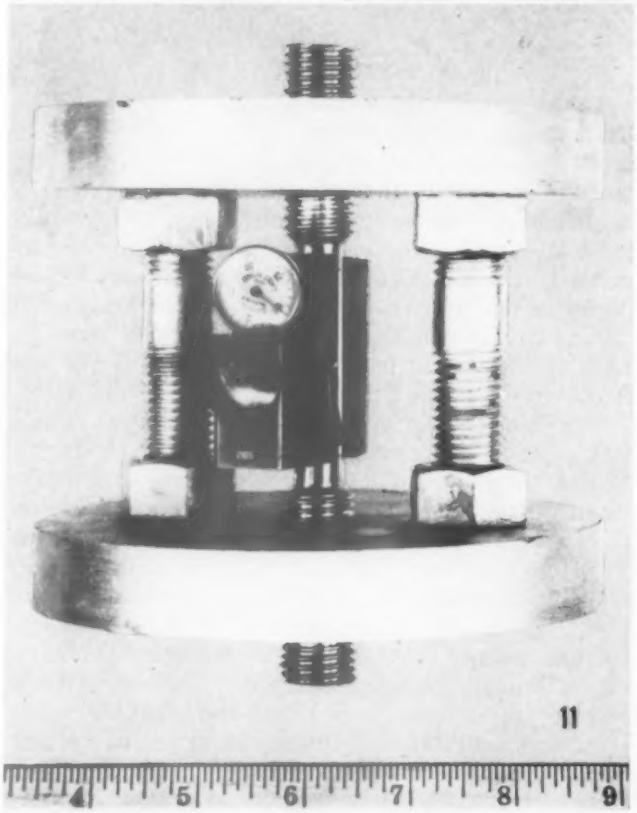
Preparation of Specimens and Jigs—One specimen obtained from each casting or heat was examined for microstructure and tested for physical properties. Stress strain curves were plotted to determine the yield strength, which is defined as that load which produces an extension under load of .01-in. in a 2-in. gage length. The remaining specimens were tested for stress corrosion data.

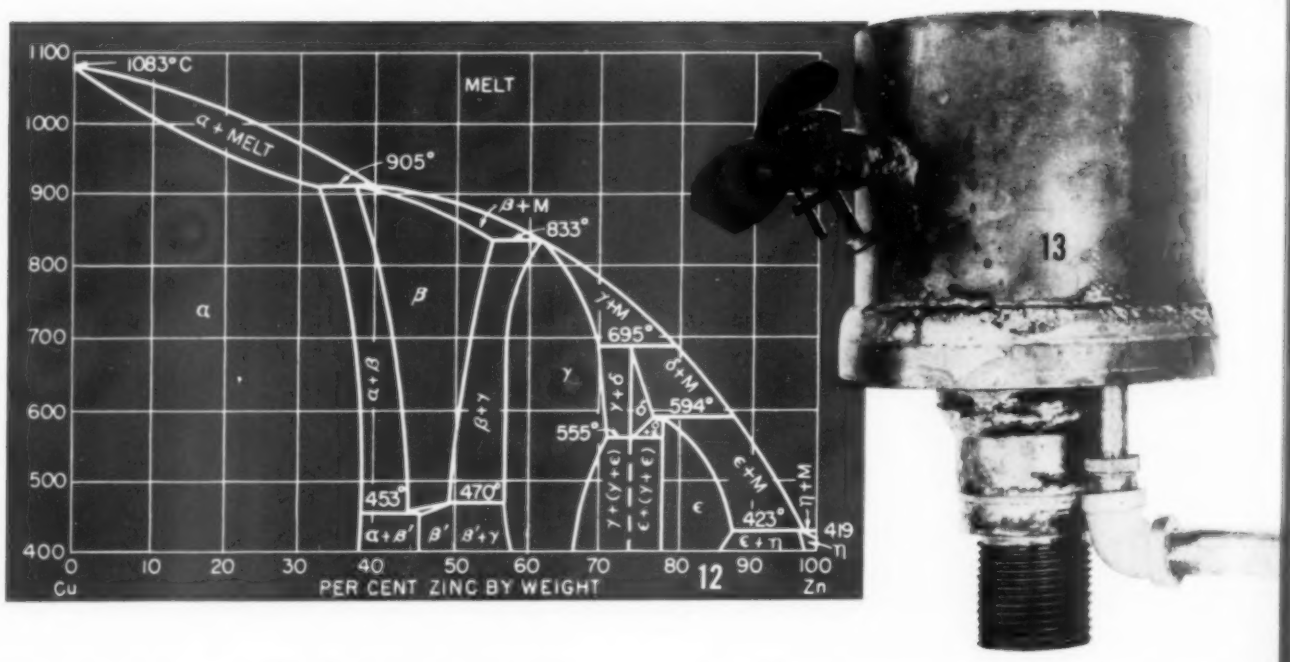
A jig was constructed as shown in Fig. 13 to be used in connection with test specimens held under continuous load in a tension machine. Any desired load could be applied to the specimen and the sea water could be maintained at any level. The sea water was changed twice weekly, and the level regulated by a drain valve located in the bottom of the jig.

In order to expedite the test, several jigs similar to that shown in Fig. 11 were made which, when used as described, allowed the specimens to be maintained under load independently of the testing machine. In this setup, the jig assembly was fixed to the top and bottom platens of the testing machine, and with an extensometer fastened to the specimen, a predetermined tension load, below the yield strength, was applied. The spacer bolts were then tightened, permitting the load indicator of the machine to fall off to zero and thereby shifting the load to the spacer bolts and the specimen under test.

There was no movement of the extensometer dial indicator fastened to the specimen—evidence that the







specimen was being maintained under the original load as applied by the tension machine. The jig assembly was then unscrewed from the tension machine and, after removing the extensometer, the assembly was submerged in a hard rubber tank containing sea water.

It was not possible to ascertain any relaxation of the load after the extensometer was removed from the specimens tested in jigs (Fig. 11). However, in the case of specimens tested in jig (Fig. 13) any relaxation of the load, as indicated by the dropping of the beam, was overcome by reloading until the beam again came into balance. It appeared that very little creep was encountered in either method and the results of test indicated that both methods were satisfactory.

Vary Loading Procedure

The loading procedure was varied from heat to heat, and in instances where several duplicate specimens were available, it was altered to furnish the most information. However, the procedure generally consisted of loading to a value slightly below the yield strength of the specimen, and immediately immersing it in sea water for a certain period of time, during which it was examined daily for cracks. If no cracks were observed at the end of the given period, the load was increased to a higher value and immersion continued, etc., until failure occurred.

The principal variation of the foregoing procedure was made in the testing of Specimens 5, 13, 14, 15, 17 and 18, where the loads were maintained at values slightly below their yield strengths for a number of days prior to immersing the assemblies in sea water. This was done with the extensometers in place to observe if the specimens could be held under a constant load. Once the spacer bolts were tightened, any further change in the load on the specimen could be detected by a change in the dial reading. The results of these tests proved that the loads were constant and indicated that the values given for the ultimate strength of specimens tested under the conditions of test as shown in Table No. I (page 190) were accurate and therefore can be relied upon with safety.

Results of Test—The data compiled from physical tests conducted in the laboratory for specimens tested under varying conditions are given in Table I.

The condition of the specimens and typical microstructures after test are shown in Figs. 7, 8, 9, 10, 14 and 15. Specimens 1 and 2 of Fig. 7 were tested in laboratory atmosphere. Specimens 3, 4, 6 and 7 were tested in sea water. Specimen 5 was maintained under load in atmosphere for six days, then in sea water for a period of eight days (its yield strength was exceeded during the last two days of this period) and when no visible cracks were noted at the end of this time the specimen was removed from the sea water and broken in atmosphere. Specimens 8 to 19 inclusive, (Figs. 8 and 9) were tested in sea water.

Photomicrograph, Fig. 10, illustrates an intergranular crack contained in specimen No. 14. Specimen 20 of Fig. 14 was tested in laboratory atmosphere. Specimens 21 to 24 were tested in sea water. Photomicrograph, Fig. 15, shows a typical crack present in the alpha beta specimen No. 24. It will be observed that the nature of this crack is transcrystalline and differs from those shown for the beta failures illustrated in Figs. 2, 4, 6 and 10, all of which are intercrystalline.

Summary—Results of this test indicate that, irrespective of microstructure, manganese bronze is sensitive to stress corrosion in sea water, and that failures occur at loads slightly in excess of the yield strength of the metal. It will be observed, however, that the alpha beta bronzes are less sensitive to these conditions than bronzes of the complete beta microstructure. A study of Table I discloses that an average maximum load of 1594 psi in excess of the yield strength was applied to the beta specimens, whereas the average maximum load in excess of the yield applied to the alpha beta specimens was 8625 psi.

In respect to the ductility of the two types of bronzes, it was calculated from Table I that the average elongation of the beta specimens was 1.9 per cent, while the average for the alpha beta specimens

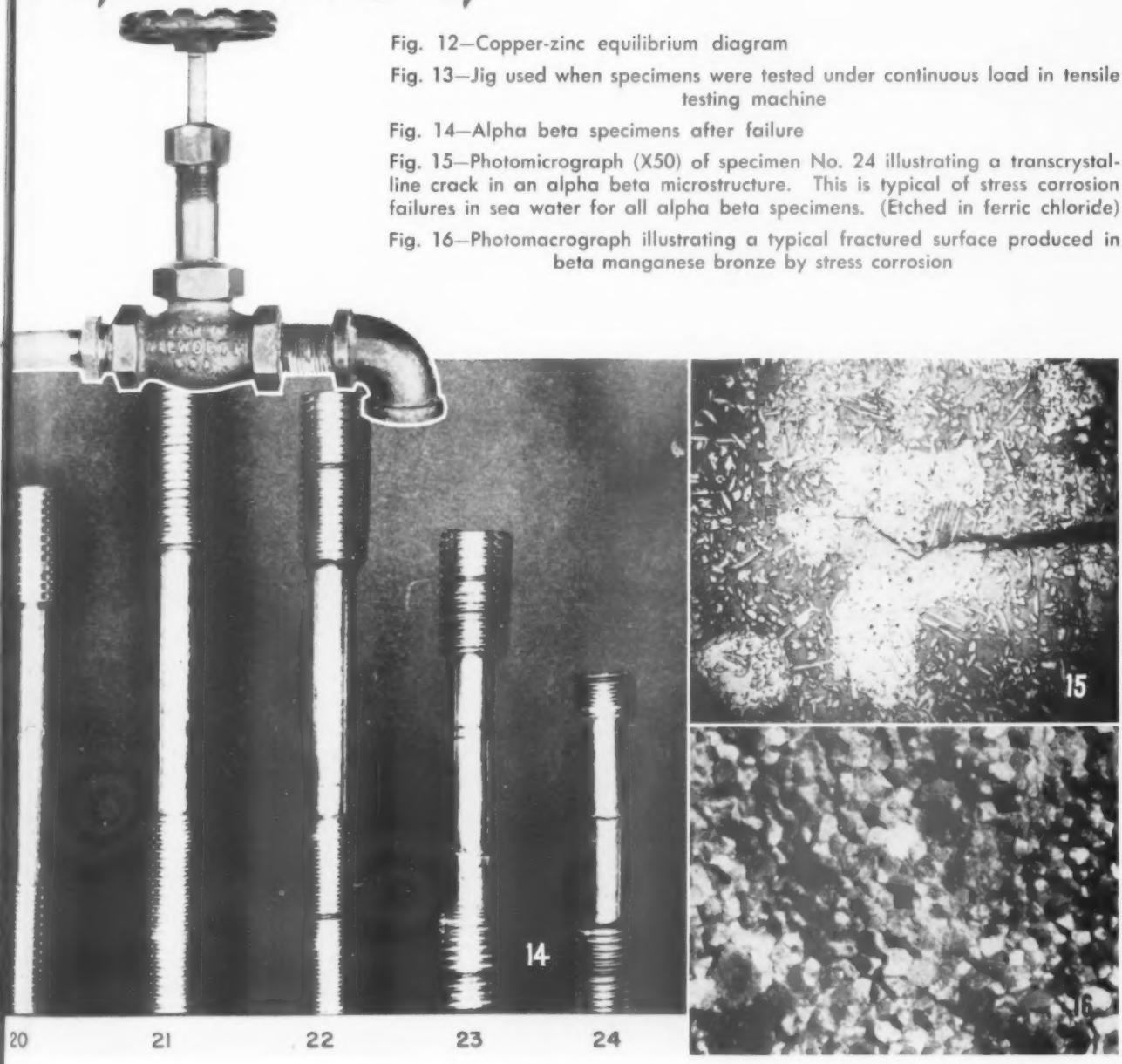
Fig. 12—Copper-zinc equilibrium diagram

Fig. 13—Jig used when specimens were tested under continuous load in tensile testing machine

Fig. 14—Alpha beta specimens after failure

Fig. 15—Photomicrograph (X50) of specimen No. 24 illustrating a transcrystalline crack in an alpha beta microstructure. This is typical of stress corrosion failures in sea water for all alpha beta specimens. (Etched in ferric chloride)

Fig. 16—Photomacrograph illustrating a typical fractured surface produced in beta manganese bronze by stress corrosion



was 8.4 per cent. The superior ductility of the alpha beta bronze, as indicated by this test, may account for its satisfactory use in outboard castings.

It will be noted that specimen No. 5 was removed from the sea water after an immersion period of eight days. During the total immersion period, it had been stressed to 37,500 psi for six days (2000 psi below its yield) and two days at 40,000 psi. Apparently, the specimen had not been attacked, as evidenced by the tensile and elongation values of 85,000 psi and 18 per cent, respectively, which were obtained on testing the specimen to destruction in laboratory atmosphere. This test indicates that slight overloading in sea water will not produce a stress corrosion failure unless sufficient time is allowed for corrosion to take place.

A comparison of the immersion periods of alpha beta bronze with the immersion periods of complete beta bronze further indicates the superiority of alpha beta bronze under stress in sea water. A study of Table I shows that the average immersion period for the beta bronze specimens maintained at loads in excess of their yield strength was 4.31 days, while the same for the alpha beta bronzes was 83.25 days.

Although this test reveals that manganese bronze of the alpha beta type and the beta type are both susceptible to stress corrosion in sea water, it is considered that emphasis should be placed on the results of examination of the many castings that failed in service. The fact cannot be ignored that all of the service failures occurred in beta bronze, which is proof in itself that manganese bronze of this structure should not be used to carry critical loads in sea water. On the other hand, (*Please turn to page* 190)

Centrifugal Casting of Soi

Fig. 1—View showing cope half of mold in position just prior to closing mold

Fig. 2 — Cast pipe just removed from cope half of mold, Model A machine

By R. L. FARABEE
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Pipe

MANUFACTURE of pipe by the centrifugal process is by no means new. References in literature prior to the turn of the century indicate that some energetic foundryman made a sand-lined mold in a cylindrical flask, poured iron into the mold and then allowed the mold to roll down a ramp built into a hillside. When the mold reached the bottom of the hill he had a pipe, provided he could find the mold. Since that time there have been tremendous developments in the production of centrifugally cast pressure pipe.

Foundrymen are familiar with the splendid developments which have been made along these lines in both the sand spun process and the de Lavaud process. Both of these processes are very successful on certain types of cast iron pressure pipe, but to the author's knowledge are not used in the manufacture of cast iron soil pipe in this country. Records of the U. S. Patent Office alone are very impressive as to the amount of work that has been done in centrifugal casting of pipe and tubular products.

The method invented by J. J. Nolan Jr., executive vice president of the Central Foundry Co., known as "The Nolan Method," is another long forward step in the art of making pipe centrifugally. The method is covered by issued and pending patents of the Central Foundry Co. in the United States and many foreign countries.

In the development of the process covered by this article, the company was confronted with the problem of finding a permanent mold method that would produce pipe with a protrusion on both ends. This was a necessity since approximately one-third of all the soil pipe sold is double-hub pipe. It was also necessary because the specifications for soil pipe do not permit the use of a pipe without a bead on the spigot end. These requirements eliminated further consideration of the single piece permanent mold, as it would be impossible to withdraw the pipe from the mold after casting.

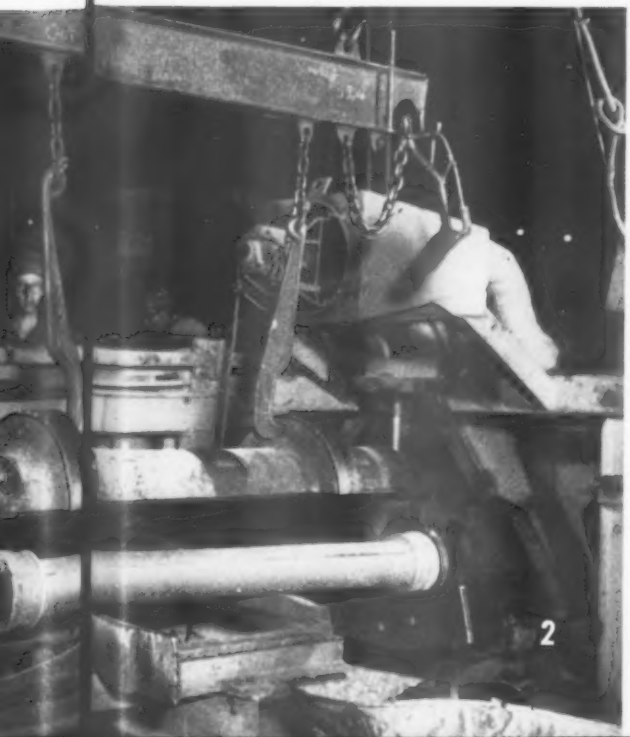
With the foregoing requirements in mind a cast iron mold split longitudinally was employed, the two halves of the mold being fitted with a joint that would prevent iron from leaking through the mold during the pouring operation.

Process Eliminates Subsequent Annealing

The split mold had been tried before in England and Germany, but the author has been unable to find any references to its actual use in the production of pipe. From here on it was necessary to chart a new course, as there was nowhere to turn for definite information as to the practicability of producing pipe in a split mold. After years of research and experimentation, the company succeeded in developing a split permanent metal mold process that produces a good quality pipe without subsequent heat treating and at an extremely high rate of production. It was discovered that if the pipe is removed from the mold as soon as it has solidified sufficiently to hold its shape, a primary metallographic structure containing a pearlitic matrix and with the remaining carbon in a preferred form of graphite is obtained without the necessity of annealing the pipe, thus reducing the cost of the pipe made by the process.

The machine used has a closed mold circuit. A service rack is located at the opening and closing side of the machine. Immediately over the machine is a mold rack where the mold from the previous cast is placed after clamping is completed. Originally an inert dry powder was used to protect the mold but this was replaced by a water suspension of the powder because of its ease and uniformity of application. The interior of the mold is sprayed with a water suspension of nonmetallic particles while on this overhead mold rack. After spraying, the hub cores are set and pinned into the mold. At the far end of this overhead rack the molds enter a lowering device which takes them to the entrance side of the machine.

The actual mold spinning mechanism consists of two horizontal power-driven shafts parallel to each other, each shaft having two grooved rollers set approximately 3½ ft apart, and with the rollers on the two shafts opposite each other. In the spinning and pouring operation a mold is cradled between these mold driving rollers. Both shafts are driven by a single motor using V-belts. Between the driving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rollers is a hydraulic lift which contacts the rollers on the mold and facilitates the removal of the mold after pouring. Rotary motion of the mold also helps accomplish this and its inertia carries it to the opening and pipe extracting station.

A precision pouring mechanism is placed at the front of the machine and meters the iron into the mold in such a manner as to uniformly distribute the molten metal over the entire length of the mold. This pouring procedure differs considerably from those commonly employed by the centrifugal casting processes for the production of cast iron pressure pipe in this country. The de Lavaud process uses a retracting pouring mechanism to uniformly distribute the molten iron into a water cooled mold. The sand spun process rotates the mold at a low speed during pouring, to obtain uniform distribution of the molten metal, then increases the speed of the mold to form the pipe. The pouring method we follow employs a special form of ladle, which is tilted by a hydraulic device that progressively decreases the velocity with which the iron enters the mold. At the same time the ladle maintains a pouring rate which permits a constant quantity of iron to enter the mold for each increment of time during pouring in such a manner as to provide uniform distribution of the molten iron in the mold. The mold is rotated at a constant speed during the entire spinning operation.

As a safety precaution a fabricated steel hood of the butterfly or flap type covers the mold during the spinning operation. The flaps of this hood are actuated by a hydraulic cylinder.

A multiplicity of molds are used on each machine at all times. The number of molds used in the circuit varies from eight down to three, depending on the production rate of the machine and the size and weight of the particular pipe being made. It is preferable to hold the temperature of the molds to approximately 800° F. This is accomplished by taking advantage of the heat imparted to the mold from the molten iron during the casting operation and correlating this heat with the time cycle of the machine. These factors together determine the number of molds required on each machine. This arrangement permits removal of a mold, for repairs or replacement, without stopping production on the machine.

A 4-in. soil pipe mold weighs approximately 1000 lb. The inside diameter is about 4½ in. and the outside about 8½ in. except at the roller sections, where it is 15 in. It must be machined so that the inside is concentric with the outside. The mold is split on the center line, and diametrical alignment is maintained by a stepped joint. A dowel pin in one half assures longitudinal matching. All molds with clamps are balanced by use of an especially designed balancing machine before they are put into the production line.

Molds used on the production machines are made from plain cast iron. Experiments with several hundred alloyed cast iron molds of various compositions disclosed none that was superior to plain cast iron, price considered. The important factors governing mold life are (1) a sound casting free from strains, (2) service temperature, (3) abuse in service, and (4) the mold coating. The purpose of the mold coating is to protect the mold from the erosive action of the iron and to prevent sticking of the pipe in the mold. Our average mold life ranges between 2000 and 3000 pipe. Some molds last longer, while some that have been plainly abused or had a casting defect fall considerably below the average. Our best average

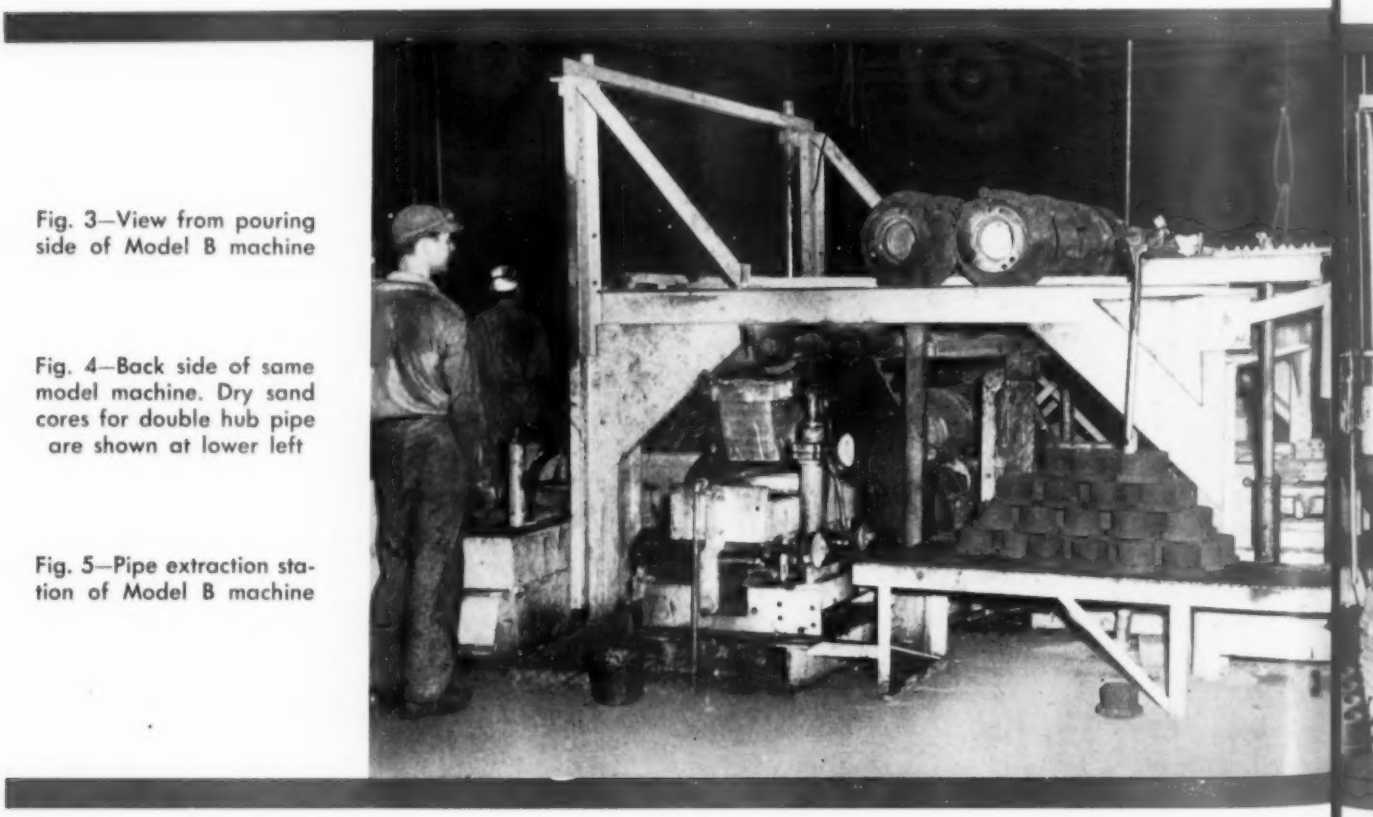


Fig. 3—View from pouring side of Model B machine

Fig. 4—Back side of same model machine. Dry sand cores for double hub pipe are shown at lower left

Fig. 5—Pipe extraction station of Model B machine

performance comes with a long, steady and high rate of production.

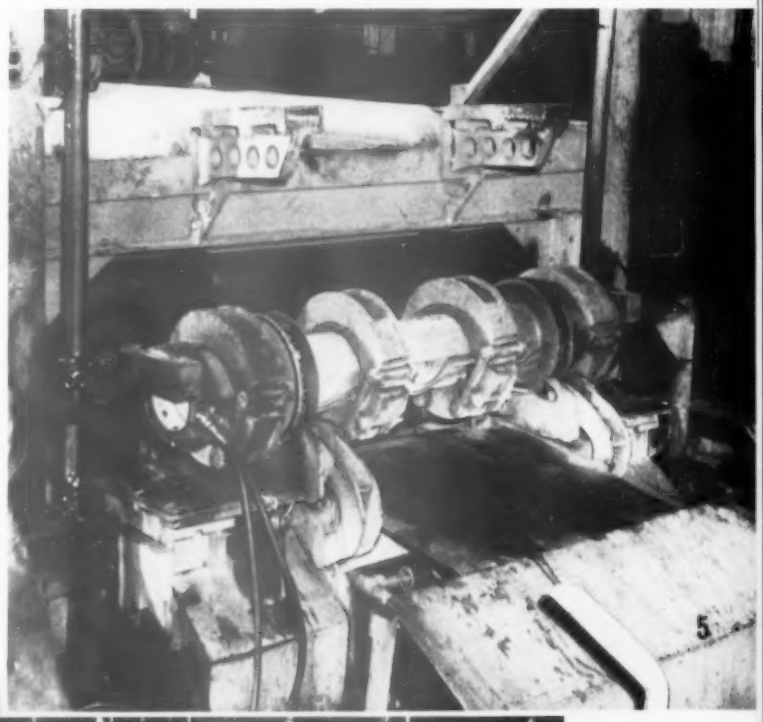
The mold clamping device is another important factor of the process. Each mold is fitted with four 2-piece hinged clamps. These are fastened together by four interconnected hydraulic cylinders which apply their force in tension simultaneously to the two halves of the clamps by the use of four U-shaped bails. Water at approximately 2000-lb pressure is applied to these hydraulic cylinders through a flexible hose fitted with rapid-connecting nipples.

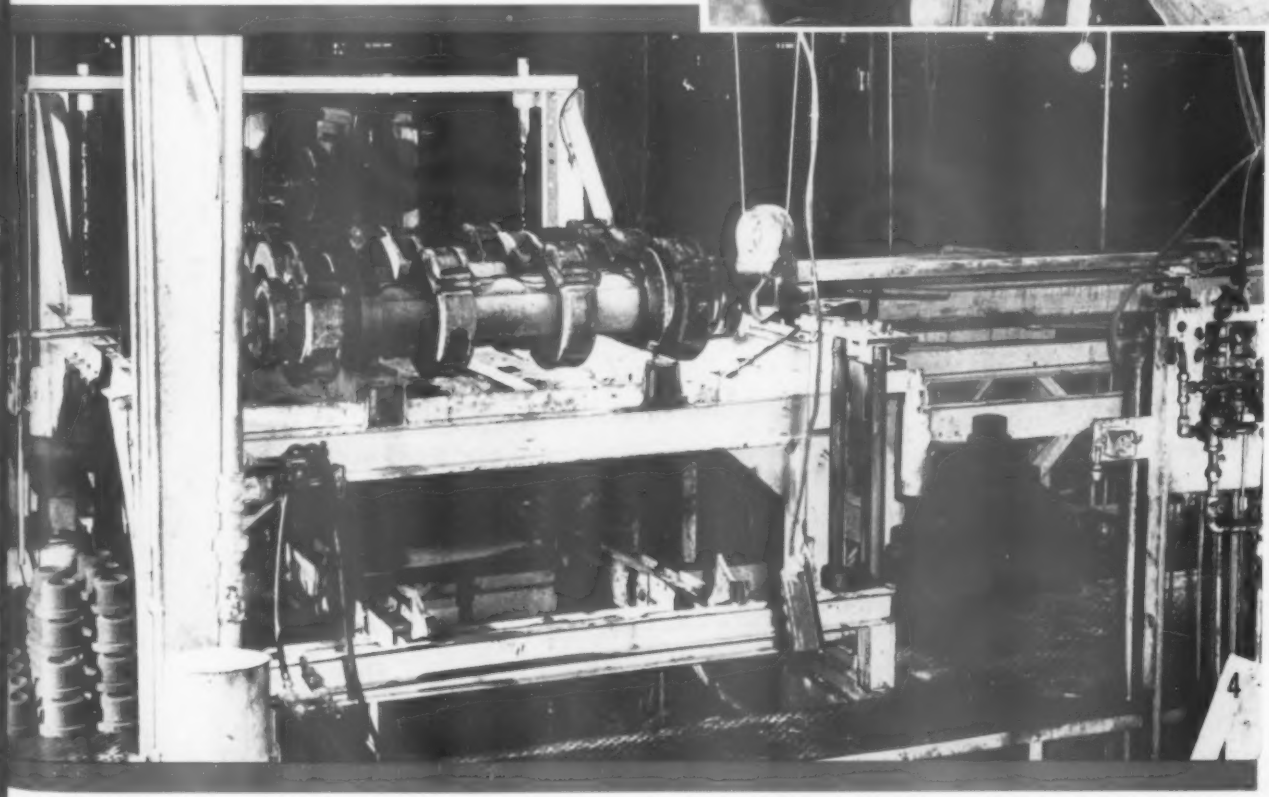
A high pressure and a low pressure hose is fitted in each hydraulic cylinder. The low pressure is used to unclamp the mold and the high pressure is used to hold the mold together during the spinning operation. Upon closing the mold and applying the 2000-lb hydraulic pressure to the clamping cylinders, the pressure is locked into the cylinders through the use of a valve. The mold is then ready to be sprayed inside with the coating and, after cores are set, to be placed in the casting position. The mold is rotated at a speed equivalent to 40 times gravity and the iron poured into the mold. The hot mold heats the clamping cylinders, thereby causing a thermal expansion of the water and, at proper temperature and pressure, forms steam which increases the clamping pressure and gives maximum clamping action when most needed. The elapsed time from clamping a mold to extracting a pipe from the next mold is 45 seconds or less.

The company now has eight production machines in operation for manufacturing soil pipe. The machines are located on 17½-ft centers. Each machine produces an average of 400 pipe per 8-hour shift, and as many as 523 pipe have been made on one machine in 7½ hours.

Process Control—During the developmental stages of this process considerable research work was done on mold speeds, pouring rates, mold compositions, mold coatings, mold temperatures, iron compositions, iron temperatures and physical properties of the product. All factors were considered carefully and the best result set up as standard.

On the production line all important factors influencing the quality of the product are checked constantly through a quality control system. These factors include iron tem- (*Please turn to page* 238)





Aluminum

Permanent mold casting of aluminum alloys is described in this seventh of a series of articles based on a survey sponsored by the Foundry Division of the Aluminum Association

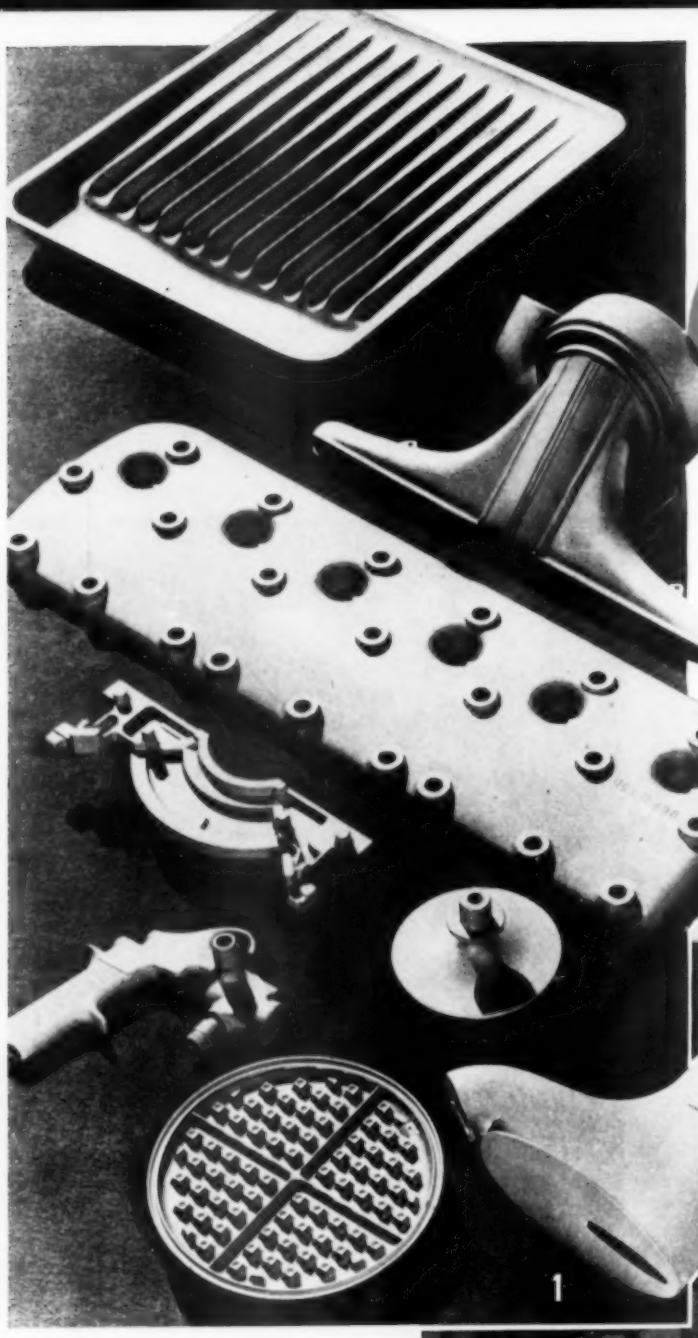


Fig. 1—Typical aluminum castings made by the permanent mold process

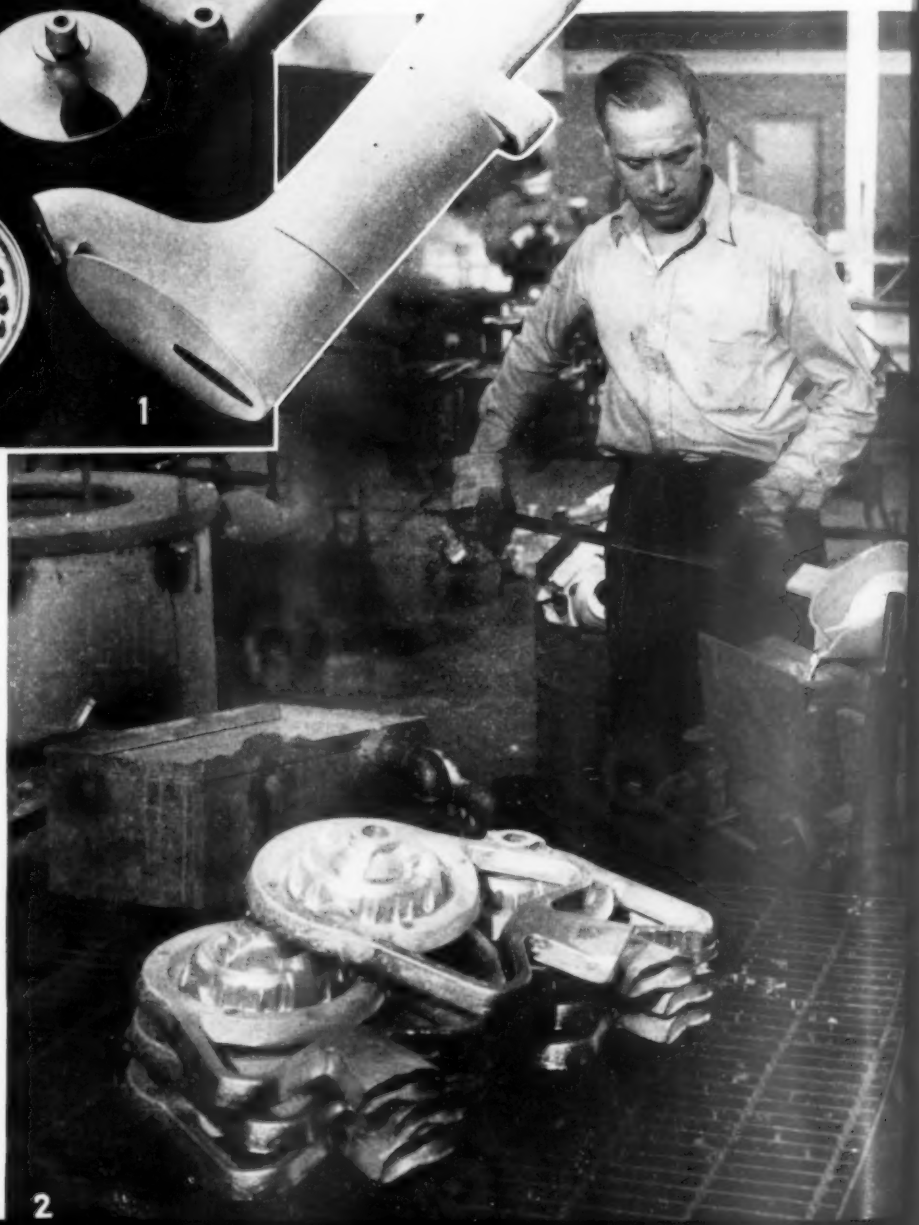


Fig. 2—Pouring molten aluminum into a permanent mold

Alloy Castings

By FLOYD A. LEWIS
Technical Consultant
Aluminum Association

ALTHOUGH a large proportion of the castings now produced by the sand casting process can also be made by the permanent mold method, the inherent differences between the two methods require somewhat different design and radically different production setups. By nature a continuous process as contrasted to the batch-process character of sand casting, the permanent mold method requires a different arrangement of foundry equipment, somewhat different methods of handling the metal, and correspondingly different production procedures.

Basically, the permanent mold process differs from sand casting in the substitution of a metal, or permanent, mold which is used for a large number of castings in place of the sand molds which are produced individually for each unit or group of units cast, as discussed in previous articles of this series. In addition, the mold must be heated before pouring can begin and held at the proper temperature continuously while production is under way. In many instances, the production operations can be so scheduled that the molten metal itself will keep the mold temperature at the proper level. In other cases, it may be necessary either to provide additional heating or to cool the mold between pouring operations.

The inherently continuous nature of the permanent mold process requires that all operations be performed in a carefully established and closely maintained continuous sequence. This continuity extends from the charging of the furnace to the final removal of the casting from the mold. Pouring temperature, mold temperature, pouring speed, ejection time—in fact, all elements entering into the pouring cycle—must be in critical adjustment to each other and be kept so. If any one of these elements is thrown out of balance, scrap castings result.

Either metal or sand cores are used, depending on the intricacy of the casting, the type of alloy, and other factors. When sand cores are employed, the process is called the semipermanent mold process. As the semipermanent mold method thus is essentially only a subdivision of the permanent-mold method, this article may be taken to apply to both throughout, except where specifically designated otherwise.

Advantages and Limitations—Since the advantages and limitations of the permanent mold process have been covered in detail in earlier articles of this series, they will only be summarized here. Because of the nature of the crystal structure developed in the alloy by the chill effect of the metal mold, the permanent mold process provides on the average the maximum strength and soundness that can be obtained by any of the present commercial casting processes. Heat treatment produces still higher mechanical properties,

and the time required for solution heat treatment is less than with other casting methods.

Castings produced in metal molds have smoother surfaces than sand castings and closer dimensional tolerances. Therefore, less finishing and machining are required which means lower metal loss. Less metal is required in permanent mold castings than in comparable sand castings because of the higher mechanical strength developed and the smaller machining allowances permissible.

The foregoing advantages, plus the high production possible with the permanent-mold method and the permanent nature of the mold itself, permit permanent

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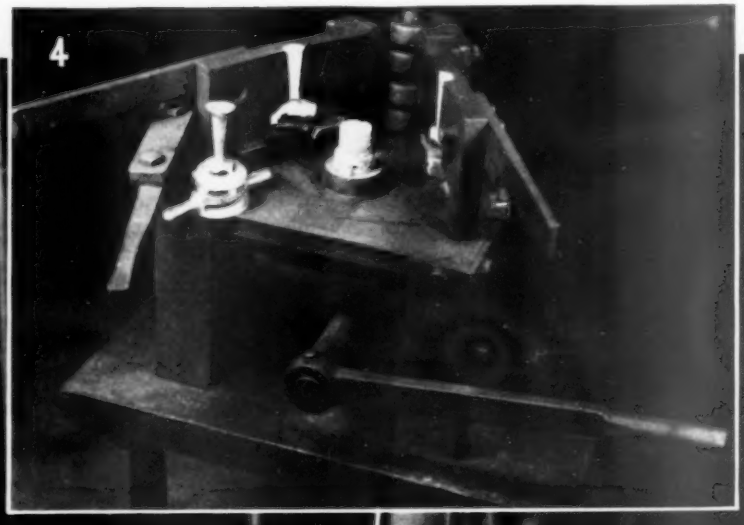
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mold castings to be brought to the point of assembly at low cost where production runs are large.

The maximum practical size of a permanent mold casting is limited by its complexity, and castings weighing several hundred pounds are being successfully produced in metal molds today. The design of a casting must be such as to permit its production within the structural and operating limitations of the mold and its cores. Too many parts in the mold or too many multiple-piece cores may make some complicated castings impractical to produce by the permanent mold method. By using sand cores, however, many castings that could not otherwise be cast in metal molds from a practical standpoint can be successfully produced by the semipermanent mold process.

Alloys that are extremely hot short or that have extremely high solidification shrinkage are difficult to cast by the permanent mold process without advanced foundry technique, because of the unyielding nature of the metal molds and cores. Alloys that are not too extreme in these respects can be cast by the semipermanent mold process, the sand cores allowing sufficient contraction to avoid solidification cracks.

Mold Design—Both the design of the casting and the design of the mold are critical elements in the production of permanent mold castings[1]. The casting design must be adapted to the requirements of the permanent mold process if the full advantages of the method are to be realized. Often changes can be made in the design stage that will simplify production, improve the product, and lower the cost of manufacture. Sometimes a fairly simple change will result in substantial savings in production time and cost. Here, as in many other aspects of foundry work, close co-operation between the designer, the mold maker and the foundryman is essential to the attainment of the best design for the process. These and other aspects of casting design were discussed in the articles presented in the May and June issues.

Permanent molds usually are constructed from a good grade of dense cast iron. Large cores ordinarily are made from the same material, while small and many multiple-piece cores often are made from a good grade of alloy steel. The cavities in the metal molds must be machined accurately in order that castings produced therein will have the required dimensions.

Gating and risering problems in permanent mold work are quite different from those involved in sand casting. In permanent molds the longest dimension of the casting generally is vertical while in sand molds it is usually horizontal. Sprue, risers, runners and gates must all be included within the mold structure, literally as part of the mold cavity. Because it is difficult and costly to make extensive changes in a metal mold once it has been completed, the entire mold feeding system must be designed in essentially final and complete form before the mold is constructed.

Fig. 3—Inspecting a rough permanent mold piston casting

Fig. 4—Casting and the permanent mold in which it was made. Mold is open to show cores and feeding system

Fig. 5—Pouring a mold containing multiple cavities. Type of casting produced shown at right

Fig. 6—Cast aluminum nozzle just removed from mold

Experience Is Best Guide

Some producers build their molds with gating and risering channels that are known to be undersized initially and then gradually increase the size of these channels until good castings are obtained. This minimizes the possibility of the molds having oversized gating and risering systems and therefore keeps to a minimum the amount of metal that must be poured per casting. Here again experience is the best guide to the optimum arrangement for a given casting.

Another important factor influencing the design of a metal mold is the necessity of keeping the mold cavity coated with a refractory material while in use. This coating serves a threefold purpose. First, it provides a protective medium between the mold metal and the molten aluminum. Second, it promotes the production of castings with smooth surfaces. Third, and most important of all, its insulating properties provide the foundryman with the necessary control over the solidification rate in different parts of the casting so as to produce the greatest number of sound castings of maximum metallurgical quality.

Simply varying the thickness of the coating applied to different parts of the mold will insure that solidification will be progressive and that the metal structure in sections of different thickness will have the required degree of uniformity. Coatings of minimum thickness are applied to that portion of the mold where solidification is to begin, and progressively thicker coatings from that portion toward the sprues and risers which must be the last to solidify. Likewise, the parts of the mold producing the heavier sections of the casting will receive thinner coatings than those producing the (*Please turn to page* 140)

AFA

Informal scenes at the AFA Foundry Show in Philadelphia which provided opportunity to talk shop, as well as to witness latest developments in foundry equipment and supplies. Top photos courtesy of John Bing, A. P. Green Fire Brick Co., Milwaukee. At left are typical aisle views of the exhibit halls

Technical Reports

Concluding reports on papers and discussions given at technical sessions of the recent 52nd annual meeting of the American Foundrymen's Association are presented here. Other sessions were reported in the June issue

FIRST of two sessions sponsored during the convention by the Job Evaluation and Time Study Committee was devoted to grinding standards as an aid in eliminating cleaning room bottlenecks. The subject was presented by Dean Van Order, Burnside Steel Foundry Co., Chicago, with the session presided over by R. J. Fisher, the Falk Corp., Milwaukee, and M. E. Annich, American Brake Shoe Co., Mahwah, N. J.

Mr. Van Order declared that standards can be established in the cleaning room as well as in other departments. The methods used, allowances granted and piece rates set will depend largely upon conditions and policies in the plant. In addition to the benefits which established methods and standard practices afford employees in the way of higher earnings, workers are trained more quickly, foremen are able to keep closer control of costs and management can do a better job of scheduling production. Also, standard data aid in predetermining job costs, in lowering costs and in increasing business volume.

The speaker stressed the importance of thoroughly scrutinizing existing methods before adopting a new or revised incentive plan. In grinding operations the following should be investigated: Sequence of casting flow through the cleaning room, with particular attention to back tracking; possibility of improving the pattern match between cope and drag; improvements of coreboxes and core prints to eliminate some of the potential core and fin.

He also suggested attention to excessive use of nails and vents which can affect snag grinding costs; to use of necked-down cores; to changes in location of heads or gates to make them more accessible to large grinding wheels; and to the use of the proper grade of wheel for the type of castings ground.

In time study work, Mr. Van Order said the engineer must use his own judgment on the type of castings to study; however, he should try to cover: A variation in weight; numerous head and gate sizes; various locations of heads and gates; amount and location of fin, and number and location of vents. The number of time studies taken should vary from 50 to 100 on each type of grinding (swing or stationary), depending on the variation of work.

A question-and-answer panel participated in the program of the second job evaluation and time study session. In addition to Messrs. Fisher and Annich, who presided, and Mr. Van Order, the panel included: M. T. Sell, Sterling Foundry, Wellington, O.; H. R. Reitinger Sr., Emerson Engineers, New York, and J. A. Westover, Westover Engineers, Milwaukee. E. S. Tetzlaff, Pelton Steel Castings Co., Milwaukee, acted as secretary. (*Please turn to page* 116)

Questions AND Answers

Stack Molding Method Suggested

Q.—We have a pattern mounted on one side of a plate to leave the cavity all in the drag, and which will be covered with a flat cope. We are interested in some procedure whereby we can use a permanent cope of some material which can be used repeatedly. Do you have any suggestions?

A.—While there are several possibilities of preparing a permanent cope, we do not believe that they would prove economical. We believe that the best procedure would be to stack your molds one on top of the other with a single downsprue connected to the several cavities. In this method the bottom of one mold serves as the cope for the one beneath, the cavity in the top mold being wasted. Sprue opening in the lowest or bottom mold is stopped off with a piece of core or filled with molding sand.

A description of this procedure is described in the February issue in the article "Old Foundry Has Face Lifted." While core molds are used, the same method applies to green sand. A somewhat different procedure is described in the March issue in the article "Multiple Molding Can Increase Production"—the difference being that the mold contains cavities in top and bottom.

Making Abrasive Faced Treads

Q.—We wish to make some cast iron stair treads which are faced with emery or some other abrasive material. Can you tell us the procedure to employ for their production?

A.—Manufacture of abrasive faced castings requires a certain amount of skill and experience, and you may have to do some experimental work to determine the most suitable procedure. Usual method is to spray the drag mold face with a thin coating of some type of adhesive material such as sodium-silicate solution, clay wash, molasses water, bentonite wash, or perhaps rubber. While the coating is still tacky the abrasive material, which may be silicon carbide, aluminum oxide, etc., is sifted on in a thin layer. The screen or sieve used should be the same mesh as the abrasive which tends to provide a more uniform spreading of the material over the surface. Mesh or size of the abrasive may be from 12 to 36, depending upon how coarse a surface is desired.

After the abrasive is in place the mold face is dried by application of a torch to drive away all excess moisture. Then the mold is closed and the iron poured. The iron should be good and hot so that it will penetrate between the abrasive grains. In some cases, instead of using one coat of abrasive it may be desirable to use two, and in that case the first is sprayed with the adhesive material, another layer of abrasive applied, and then both are torch dried.

Cast Iron Fittings Contain Holes

Q.—We are sending you a piece of a cast iron fitting after cleaning which contains a number of holes. We call the holes slag inclusions, and we do not know what causes this defect. Trouble does not seem to be in the whole shop—only in the fitting department. Iron is delivered in bull ladles, then poured into the hand ladles and from the hand ladles into the molds. When the molders skim the hand ladles, they have considerable trouble keeping the dirt or other matter skimmed off as it continually seems to be coming up. In other departments molds are poured direct from bull ladles. Our contention is that the iron is not hot enough to be skimmed properly. Iron charge is composed of 700 lb pig iron (2.02 Si) 40 lb silvery pig (10.50 Si), 1330 lb machinery scrap (1.80 Si), 900 lb home scrap, 15 lb silicon briquets (40.0 Si), and 15 lb silicon-manganese briquets (14.0 Si). Borings sent to chemist show 2.39 per cent Si, 0.123 per cent S, 0.43 per cent P, 0.97 per cent Mn. Fittings are poured after the cupola has been in operation for nearly 4 hr, melting at the rate of 15 tons per hr. We use 280-lb coke splits, but also have used 300-lb splits without any better results.

A.—According to our calculations the raw materials being charged should give an iron at the spout containing 2.16 per cent Si, while your analysis shows 2.39 per cent. That does not agree with accepted practices since a loss of 10 per cent or so usually is encountered. Possibly you are charging more silicon than indicated, or some siliceous matter (sand or slag) is present in the borings submitted for analysis.

From your mention of coke splits of 280 lb to 3000-lb iron charges, we would expect an exceedingly high silicon loss. That indicates a ratio of 1 to 10.7 which is rather unusual, especially in these days when coke quality is none too good—cupola and blast furnace operators finding it necessary to use more rather than less coke. We believe that your complaint of the iron not being hot enough is probably true due to not sufficient coke being used between iron charges.

Your description of the appearance of the iron in the hand ladles (scum or dirt constantly coming to the surface) suggests that the iron is oxidized. However, that same appearance can be caused by use of damp ladles which do not contain sufficient moisture to develop an observable boiling action. In that case the iron absorbs water vapor or hydrogen, resulting in unsound castings. If a damp ladle is the cause, the action should cease after it has been filled and emptied a few times.

You state that you tried increasing the coke split to 300 lb without any noticeable effect, and that we can believe because it hardly is sufficient in our estimation. To obtain hot iron we would expect a coke-

to-iron ratio of 1 to 8 or 375 lb coke to 3000 lb iron. In your case we suggest that instead of increasing the coke, you reduce the iron charge to 2500 lb as a start, although 2200 lb would be better, and see whether that increases the temperature sufficiently. If not, reduce the iron charge to 2000 lb. Also see that the bed in the cupola is around 48 in. above the tops of the tuyeres after burning in.

Suggests Corrective Measures

Q.—Do you know of any material in which we can boil bronze castings to overcome porosity? The castings have to withstand 250 psi air pressure.

A.—Your inquiry evidently refers to what commonly is termed impregnation, or sealing. Base material is one of the synthetic resins in liquid form with or without filling agent. Castings may be immersed in the liquid for a sufficient time to permit it to enter the porous areas, or it may be forced into them by pressure, or by a combination of subjection to evacuation followed by pressure. Following any of those operations, the castings are allowed to drain to remove the excess material, and then baked at elevated temperatures to polymerize or condense the material into solid form. Makers of such materials may be found in the advertising pages of THE FOUNDRY.

However, employment of such procedure does not get at the root of the trouble, which may be due to several causes. One is melting practice which permits absorption of gas, another is gating and risering practice which does not allow sufficient feeding during solidification, a third might be too high a pouring temperature, and the fourth may be sand condition which causes a slight but definite agitation or boiling of the metal. We suggest that you fracture a number of castings at the affected area and examine them to determine the most likely offender, and then make the necessary changes to correct the fault.

Requests Information on Sands

Q.—We operate a foundry in India and manufacture plows, bullock and power driven cane crushers, hand pumps and centrifugal pumps. We have trouble in getting the proper sand mixtures for our work and would like complete information on moisture content, proportions of sand and loam, etc. We expect to get a sand conditioning plant, and feel that with such information our work will be much easier. Also we would like information on core sand. We can get plenty of raw or boiled linseed oil. What should be the proportion of linseed oil in the core sand?

A.—You do not mention whether you have equipment for determining various properties of sand such as permeability, moisture content, green compression strength, etc., and to maintain any type of sand control, it is essential that such equipment be employed. Also available information usually is based on those and other properties. For example, one foundry uses for castings up to 1000 lb a molding sand prepared from silica sand and a clay or bentonite bond. It shows the following: Moisture 4.5 to 5.5 per cent, permeability 80 to 100, and green compression strength 7.5 to 8.5 psi. For castings weighing from 100 to 300 lb synthetic or natural sand showing the following is used: Moisture 5.5 to 6.5 per cent, permeability 45 to 70, and green compression strength 6.8 to 8.8 psi. For castings weighing from 1 to 100 lb a natural sand is used with the following properties: Moisture 6 to 7 per cent, permeability 18 to 40, and green compression strength 6.0 to 7.5 psi.

By sand and loam content you presumably mean the relation of sand and bond or clay, but you do not indicate whether you have in mind natural sand or synthetic sand. In natural sand you do not have much choice of the amount of bond except by modification through additions of bond-free sand to decrease the total bond, or by adding bonding material to increase it. Natural sands may vary in clay content from 8 or 9 to 40 per cent. Amount of bond in synthetic sands will depend upon the type of bonding material and the type of work being poured. With bentonites the bond may run from 4 to 6 per cent while with fireclays it may be from 10 to 15 per cent.

Amount of linseed oil for production of cores will depend upon the kind of sand being used, that is whether it is clay-free or not; and upon the characteristics desired. For example, if a stiff core to withstand handling is wanted, more oil will be required. In general, it is preferable to use the least amount of oil to give a suitable core, and in this country the range is from 1 part of oil to 60 to 100 parts of sand by weight. If some sand containing clay is used to provide green strength, more oil will be required than when no clay is present. In the latter case about 1 per cent cereal bond will give the desired green strength.

GANGWAY!

By J. A. PATTERSON

"There, 5,786,421,397 grains! My guess is th' closest—so I win th' beer, Murchison!"

Frank C. Riecks Elected Director of AFA

FRANK C. RIECKS, manager of foundry operations, Ford Motor Co., Dearborn, Mich., was elected a national director of the American Foundrymen's Association at a meeting of the board held in Philadelphia, May 4. He will fill the unexpired term of the late Russell H. McCarroll, Ford director of chemical and metallurgical engineering and metallurgical research, who died Mar. 31.

A native of Alpena, Mich., and a 1916 graduate of the University of Michigan with a degree in mechanical engineering, Mr. Riecks has been associated with the Ford organization since 1916 when he joined the company as a power plant draftsman. His early connection was interrupted by World War I service, first as a second lieutenant of artillery and later with the American Handley-Paige Bomber Squadron in England. Returning to Ford, he participated in construction work at the new Rouge plant, and from 1925 to 1931 was in charge of building the open-hearth and steel plant there.

In the ensuing years Mr. Riecks served as assistant chief plant engineer, handling various projects both here and abroad. Foreign construction included a plant at Yokohama, Japan—which was halted by the Japanese in 1937 by the war scare—and an automotive plant built near Paris just before World War II. At home

FRANK C. RIECKS

Mr. Riecks was identified with such wartime projects as the Willow Run bomber plant, plants for building tanks and aircraft engines, and several aluminum, gray iron and magnesium foundries. In 1945 he was placed in charge of the rehabilitation of the Rouge gray iron foundries, involving expenditures of $12 million to increase production 25 per cent with a corresponding reduction in manpower and a 100 per cent improvement in working conditions.

Last December Mr. Riecks was made manager of Ford's foundry operations, including the production and jobbing foundries, and the metal and wood pattern shops.

Malleable Founders' Annual Meeting

Collins L. Carter, president, Albion Malleable Iron Co., Albion, Mich., was elected president of the Malleable Founders' Society for the coming year at its 51st annual meeting at Hot Springs, Va., June 10-11. He succeeds Wilson H. Moriarty, vice president, National Malleable & Steel Castings Co., Cleveland.

James H. Smith, general manager, Central Foundry Division, General Motors Corp., Saginaw, Mich., was elected vice president. Four new directors taking office are John A. Wagner, president, Wagner Malleable Iron Co., Decatur, Ill.; John T. Llewellyn II, president, Chicago Malleable Castings Co., Chicago; Frank O. Parker, vice president, Dayton Malleable Iron Co., Dayton, O., and H. Nelson Albright, manager, Columbia Malleable Castings Corp., Columbia, Pa.

The society honored Robert R. Fauntleroy, president, Moline Malleable Iron Co., St. Charles, Ill., with the Charles H. McCrea medal for the person "rendering the most outstanding service to the malleable iron industry." Te is a three-time past president of the organization. The presentation address was made by Brinton Welser, vice president, Chain Belt Co., Milwaukee.

A full report on the annual meeting will be presented in THE FOUNDRY for August.

Purdue Plans Metals Casting Conference

A Metals Casting Conference will be held at Purdue University, West Lafayette, Ind., Nov. 4 and 5, to consider foundry problems from both top management and supervisory levels. The conference will be sponsored by the Department of General Engineering, the School of Chemical and Metallurgical Engineering, and the Technical Extension Division, in co-operation with the Central Indiana Chapter of AFA and the Michiana Chapter of AFA.

The committee handling arrangements for the conference is as follows: Chairman, C. T. Marek, assistant professor in charge of casting processes; secretary, R. W. Lindley, professor in charge of engineering shops; H. A. Bolz, professor heading the department of General Engineering; G. M. Enos, professor of Metallurgical Engineering, P. H. Harlan, vice president, Electric Steel Casting Co., Indianapolis, and representing the Central Indiana Chapter, and F. T. McGuire, Sibley Machine & Foundry Corp., South Bend, and representing the Michiana Chapter.

New Officers Chosen By FEF

New officers were elected by the Foundry Educational Foundation following its second annual meeting, held in Philadelphia, May 5. The meeting featured a report by the foundation president, Anthony Haswell, president, Dayton Malleable Iron Co., Dayton, O., and the announcement of the appointment of trustees by the four founding member organizations, as well as the election of trustees at large.

Trustees met subsequently to approve disbursement of scholarship and equipment funds for 1948-49, and to elect the following officers: Chairman, Anthony Haswell; president, Peter E. Rentschler, president, Hamilton Foundry & Machine Co., Hamilton, O.; vice president, Richard W. Crannell, vice president, Lehigh Foundries Inc., Easton, Pa.; secretary-treasurer, Charles A. Barnett, president, Foundry Equipment Co., Cleveland; executive director, George K. Dreher, Foundry Educational Foundation, Cleveland.

The board of trustees now is constituted as follows: Malleable Founders' Society—Anthony Haswell and Richard W. Crannell. Gray Iron Founders' Society—John M. Price, president, Ferro Machine & Foundry Inc., Cleveland, and Peter E. Rentschler. American Foundrymen's Assocation—Stowell Wasson, vice president, National Malleable & Steel Castings Co., Chicago, and Fred Sefing, International Nickel Co., New York. Foundry Equipment Manufacturers Association—Bruce L. Simpson, president, National Engineering Co., Chicago, and Charles A. Barnett. Trustees at large—J. H. Smith, general manager, Central Foundry Division, General Motors Corp.; George F. Hutchins II, treasurer, Standard Foundry Co., Worcester, Mass.; B. D. Claffey, vice president, Acme Aluminum Alloys Inc., Dayton, O.; C. R. Culling, president, Carondelet Foundry Co., St. Louis; Brinton Welser, vice president, Chain Belt Co., Milwaukee.

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PROMOTES SOUND CASTINGS — Diffusing rapidly throughout the melt, Nisiloy promotes a dense, close-grained product.

CURBS BREAKAGE — Even where section thickness varies sharply, Nisiloy serves to eliminate chilled edges and surfaces, thus affording a tougher cast iron that resists breakage in shop handling.

NO SCRAP PROBLEM—Containing only elements that dissolve freely in iron, Nisiloy permits remelting sprues and gates in any successive melt without risk of adding chill-forming elements.

FEWER BASE MIXTURES—Often a single base mixture may be used in the cupola to which Nisiloy is added in the ladle, with the consequent flexibility of pouring off thin or thick sectioned castings as desired.

Use the coupon below for full information about one of the most useful products ever offered for improving machinability and structure of gray iron castings. Nisiloy contains 60 per cent nickel, 30 per cent silicon, balance essentially iron. Fill in and mail the coupon now.

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Men OF INDUSTRY

WILLIAM L. DEAN has been elected president and general manager of Mathews Conveyor Co., Ellwood City, Pa., succeeding **F. E. Moore,** who has been made chairman of the board of directors of the company and its subsidiaries. Mr. Dean is also president of Mathews Conveyer Co., West Coast, San Carlos, Calif., and Mathews Conveyor Co. Ltd., Port Hope, Ont. He has been associated with the Mathews organization since 1909 and had been vice president and general manager since 1943.

♦ ♦ ♦

John L. Lowe has been appointed plant manager, Chicago Foundry Co., Chicago. Mr. Lowe, a graduate of Michigan State College was formerly associated with Campbell, Wyant & Cannon Foundry Co., Muskegon Heights, Mich., Vilter Mfg. Co., Milwaukee, Pontiac Motor Co., Pontiac, Mich., Battelle Memorial Institute and the Gray Iron Research Institute Inc., and United States Pipe & Foundry Co., Burlington, N. J. **James F. Duffy,** who has been comptroller of Chicago Foundry Co. for several years, has been named treasurer.

♦ ♦ ♦

Charles O. Burgess has been appointed technical director of the Gray Iron Founders' Society, Cleveland. Mr. Burgess was graduated from Lehigh University in 1923 with a metallurgical engineering degree and shortly after joined the Union Carbide & Carbon Research Laboratories, Niagara Falls, N. Y., where he instituted that company's cast iron department. Subsequently he has headed Union Carbide's steel and cast iron research and service departments, being responsible for research dealing with the improvement and application of a wide range of ferrous materials. Among 14 patents issued him in the metallurgical field are those concerned with the development of the inoculation process for cast iron. Mr. Burgess is well known for his writings and talks before technical societies, including AFA, ASM, AIME and ASTM. He is past chairman of the AFA Gray Iron Division and of the executive committee of ASTM Committee A-7 on Malleable Iron, and currently is secretary of ASTM Committee A-3 on Cast Iron. During World War II Mr. Burgess was a special member of the War Metallurgy Committee.

♦ ♦ ♦

Robert C. Woodward, who has been elected president of the Wisconsin Chapter of the American Foundrymen's Association for 1948-49, is chief metallurgist, Bucyrus-Erie Co., South Milwaukee, Wis. Mr. Woodward was born in North Syracuse, N. Y., and was graduated from Leland Stanford University. He served successively as metallurgist at Sweet's Steel Co., and Lycoming Motors Corp., of Williamsport, Pa., and National Brake & Electric Co., a division of Westinghouse Air Brake Co., Milwaukee. Following a short period as superintendent, Smith Steel Foundry Co., Milwaukee, he joined Bucyrus-Erie Co. in 1935, as chief metallurgist. During the recent war he served also as superintendent of its foundries and pattern shops. Mr. Woodward has served as secretary of the Wisconsin Chapter and as vice president last year.

♦ ♦ ♦

Frank E. Wartgow has been appointed foundry engineer, Hydro-Blast Corp., Chicago. Mr. Wartgow has had a broad background and extensive experience in the foundry industry. Previous connections include the Foundry Equipment Division, Whiting Corp., Harvey, Ill., office manager in charge of exhibits, American Foundrymen's Association, supervising engineer, Hasbrouck Haynes Engineers, and supervisory positions with American Steel Foundries, all of Chicago.

♦ ♦ ♦

Julius A. Kayser, formerly assistant to the president, Laclede-Christy Clay Products Co., St. Louis, has been appointed resident vice president and manager of Pacific coast activities, and **Russell K. Wasmann** has been made district manager, both with headquarters at 391 Sutter St., San Francisco. **William E. Daugherty** has been appointed district manager in Los Angeles, with offices at 609 South Grand Ave. **Walter Emes** has been named superintendent of the West coast plant, recently completed at Warm Springs, Calif.

♦ ♦ ♦

Dr. Harold Vagtborg has resigned as president and director of Midwest Research Institute, Kansas City, Mo., to accept appointment as president and director of Southwest Research Institute, Houston, Tex. Dr. Vagt-

(Continued on page 104)

WILLIAM L. DEAN

JOHN L. LOWE

CHARLES O. BURGESS

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(*Continued from page* 102)

borg will also act as director of the Institute of Inventive Research and the Foundation of Applied Research, just outside San Antonio, Tex. **Dr. George E. Ziegler** will continue as executive scientist and will handle administrative responsibilities until Dr. Vagtborg's successor is appointed at Midwest Research Institute.

♦ ♦ ♦

Chester K. Faunt, recently elected president of the Chicago Chapter of the American Foundrymen's Association for the year 1948-49, is works manager, Christensen & Olsen Foundry Co., Chicago. Mr. Faunt, a native of that city, attended high school there and became associated with Faunt Bros., Chicago, in 1919. He was vice president of that company when it suspended operations in 1938. He joined Christensen & Olsen Foundry Co. at that time. During the recent war he served on the Brass and Bronze Foundry Industry Advisory Committee, Office of Price Administration, Washington. Mr. Faunt has been active in foundry groups for many years and was one of the organizers of the Chicago Brass Manufacturers Association. He served as president of the Non-Ferrous Founders' Society in 1942-1943, and is one of its present directors. He has held various offices in the Chicago Chapter of the AFA, and was its vice president last year.

♦ ♦ ♦

Glenn C. Merkley, until recently manager of the San Francisco office of the National Supply Co., Pittsburgh, has been appointed manager of the new Industrial Products Division of its Torrance, Calif., plant. Mr. Merkley's new duties will be in connection with expansion of the Torrance plant to produce steel castings and forgings to meet increasing requirements of western industry.

John J. Lincoln Jr., director of sales services, Air Reduction Sales Co., New York, has been elected president of the International Acetylene Association. **A. J. Fausek,** president, Modern Engineering Co., St. Louis, was elected to succeed Mr. Lincoln as vice president, and **E. V. David,** assistant manager of the technical sales division, Air Reduction Sales Co., New York, was named treasurer. **H. F. Reinhard** was reelected secretary. Mr. Lincoln was graduated from Yale University in 1924, and immediately joined Air Reduction Sales Co. as a salesman. Later he was appointed manager of the Bettendorf, Iowa, and Pittsburgh sales districts, assistant sales manager in 1937 and director of sales services in 1945.

♦ ♦ ♦

Graham J. Logan has been appointed assistant superintendent, McConway & Torley Corp., Pittsburgh. Mr. Logan was associated with Verona Steel Casting Co. and Fort Pitt Malleable Co., McKees Rocks, Pa., prior to joining McConway & Torley Corp. in 1922. He has been engaged in pattern shop and foundry operations for more than 35 years.

♦ ♦ ♦

D. A. Paull, on special assignment with the works manager's staff of the Sealed Power Corp., Muskegon, Mich., has been appointed manager of its new Ionia, Mich., plant, which will manufacture castings for piston rings. Mr. Paull has been associated with the company since 1942.

♦ ♦ ♦

William J. Grede, president of Grede Foundries Inc., Milwaukee, has been presented a key award by the Marquette University junior chapter of the Institute of Industrial Engineers and Executives, for the qualities of leadership, initiative and ability for which the institute stands. Mr. Grede was cited as having applied modern management, engineering and selling techniques to the foundry business.

♦ ♦ ♦

Dale Torgeson has joined the research department, Harbison-Walker Refractories Co., Pittsburgh. Mr. Torgeson, who was graduated from University of Kansas with a degree in chemical engineering, took graduate work at University of Colorado. Recently he has been associated with the Bureau of Mines, Boulder City, Nev., and Berkeley, Calif. Prior to joining the Bureau of Mines he was chief chemist, Northwest Magnesite Co., Cape May, N. J.

♦ ♦ ♦

W. J. Holtmeier has been appointed eastern district manager for the Standard Electrical Tool Co., Cincinnati. Mr. Holtmeier's headquarters will be in New York and he will cover Connecticut, northern New Jersey, Rhode Island, metropolitan New York, eastern Pennsylvania and part of New York State.

♦ ♦ ♦

Emmit W. Archer has joined Dow Chemical Co., Midland, Mich., as research and development engineer in the magnesium laboratory. Mr. Archer, who was graduated from University of Indiana in 1943, had been associated with the Udylite Corp., Detroit, prior to joining Dow Chemical.

♦ ♦ ♦

C. A. Orr has retired as president and general manager, Union Metal Mfg. Co., Canton, O., continuing as chairman of the board of directors. **C. A. Streb,** who has been with the company since 1926, and secretary the last 11 years, succeeds Mr. Orr as president. Other appointments include the promotion of **E. W. Riemenschneider,** chief engineer, to vice

(*Continued on page* 108)

CHESTER K. FAUNT

GLENN C. MERKLEY

JOHN J. LINCOLN JR.

GRAHAM J. LOGAN

Only the Robins Floatex Shakeout can perform these two foundry operations without removing the casting!

No wonder this Robins Floatex Shakeout is saving time . . . money . . . headaches.

First, it shakes out the 5800-lb. flask, containing a 2600-lb. casting with a 1200-lb. core. Time: 3 minutes.

Then, while the casting remains on the deck, it knocks out the core! Knockout time: 2 minutes.

No longer need the casting be taken to another point on the foundry floor, where men remove the core with sledges or mechanical hammers! The entire job is done as *one* operation with *one* machine.

Only the Robins Floatex Shakeout is powerful enough to knock out heavy cores as well as to shake out flasks—without damaging either! And only the Robins Floatex Shakeout is genuinely full-floating; it shakes the flask, not the foundry!

What is more, *only* the Floatex has a stroke adjustable to each shakeout or knockout requirement . . . from a unit as big as the hull of a General Sherman tank to one as small as a household valve.

Whether you want to do shakeout and knockout as a single operation or shakeout at night and knockout in daytime (when machine would otherwise be idle), write Robins.

Learn how both jobs can be done with *one* machine . . . by making only *one* investment.

ROBINS

FLOATEX SHAKEOUT

WRITE TODAY. Learn how you can save time, money and headaches by installing a Robins Floatex Shakeout. Made in portable and stationary types—with or without automatic, mechanical self-discharge feature. Address Robins Conveyors Division, 270 Passaic Avenue, Passaic, N. J.

ROBINS CONVEYORS DIVISION HEWITT-ROBINS INCORPORATED

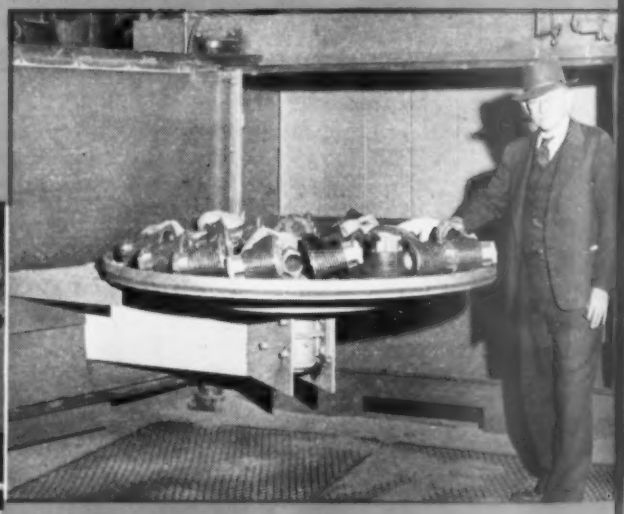
Pictures Tell the Story about *WHEELABRATOR*

Above: This 66" Wheelabrator Swing Table replaced 3 tumbling mills and considerable airblast room time at the Chemung Foundry Co., Elmira, New York. Loads weighing up to 1500 pounds are cleaned in 3 minutes each side.

Examine the pictures and you will see how the Swing Table . . . an exclusive *American* development . . . solves some of the most troublesome and costly cleaning problems confronting management today.

Essentially, the machine is a blast room equipped with a rotating work table. As the door is opened, the table swings out with it for convenient loading or unloading. When the door is closed, the table rotates beneath the blast from an Airless Wheelabrator which scours away

Below: Replacing an airblast room and 2 tumbling mills at the Iroquois Foundry Co., Racine, Wisconsin, this 72" Wheelabrator Swing Table cleans 2500 pound loads in 3 to 5 minutes. The machine eliminated four men from the cleaning room.



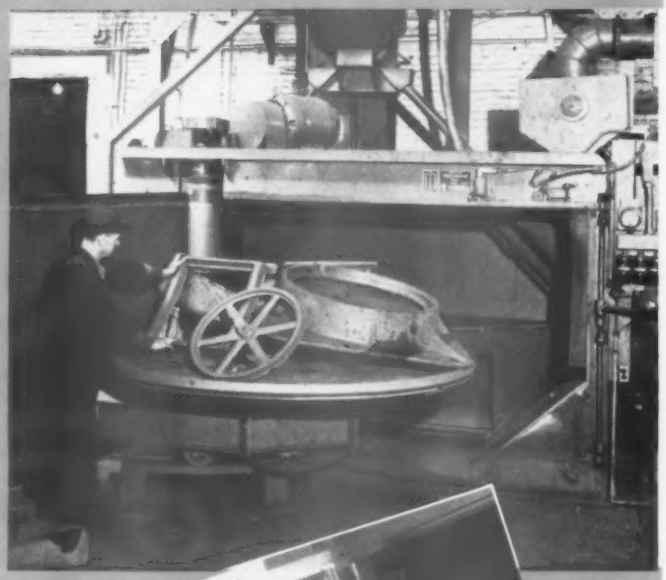
Above: 26 motorcycle cylinders or 7 truck engine heads are cleaned in 3 minutes per side with a 66" Wheelabrator Swing Table at the Manufacturers Foundry Co., Waterbury, Conn. Cleaning is faster and more uniform compared with the airblast room previously used.

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

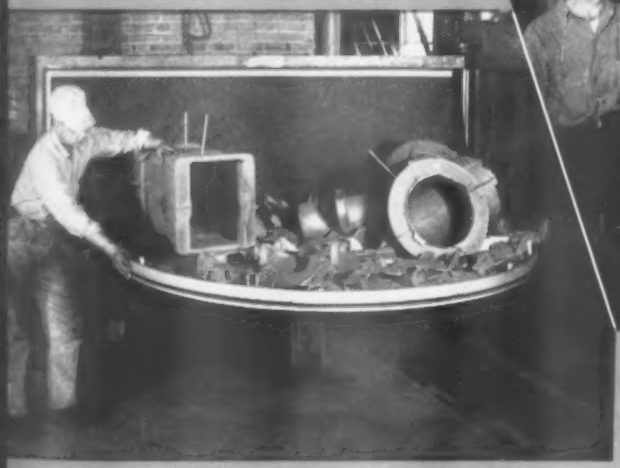
SWING TABLE Advantages

sand and scale from every nook and cranny.

Operating in this manner, the Swing Table replaces the unhygienic air-blast room on 80 % of all work and becomes a versatile general purpose machine for the shop whose work would otherwise require the purchase of several different types of cleaning machines. Equally important are the benefits provided by the Wheelabrator in slashing costs and increasing output.



Upper Right: This 86" Wheelabrator Swing Table, installed at Sessions Foundry Company, Bristol, Conn., replaced 2 tumbling mills and an airblast room. It cleans loads of castings weighing up to 5000 pounds in 4 minutes.



Above: Cleaning a quantity of castings in 3 hours that formerly required 8 hours to clean by airblasting, the 66" Wheelabrator Swing Table installed at the Fairview Foundry Co., replaced an airblast room, table and 3 tumbling mills.

Above: At the McNally-Pittsburgh Foundry Co., Pittsburg, Kansas this Wheelabrator Swing Table cleans a 72" diameter sheave in 15 minutes that formerly required 4 hours to clean in an airblast room. Seven men were relieved for more productive work.

The new Swing Table Catalog No. 214-A is now available. It graphically describes the speed, economy and versatility of all five Swing Table sizes.

American

Wheelabrator & Equipment Corp.

(Formerly American Foundry Equipment Co.)

505 S. Byrkit St., Mishawaka 2, Indiana

(*Continued from page* 104)

president in charge of engineering; **A. R. Jones,** assistant secretary, to secretary; and **D. B. Hanna,** assistant general manager, to general manager. **W. A. Porterfield** was re-elected vice president in charge of sales promotion and **E. C. Moore** as treasurer.

♦ ♦ ♦

O. L. Voisard, recently elected chairman of the Eastern Canada-Newfoundland Chapter of the American Foundrymen's Association, is general superintendent, the Robert Mitchell Co. Ltd., St. Laurent, Quebec. Mr. Voisard served his apprenticeship at Garth's Foundry, Montreal, which he entered in 1910 as a molder. In 1920 he was appointed foreman of the ferrous and nonferrous foundries, Peacock Bros. Ltd., Montreal, where he remained until 1928, when he became general foreman of the foundry division of Robert Mitchell Co. Ltd. Later he was appointed assistant superintendent, becoming general superintendent two years ago. Mr. Voisard was one of the organizers of Eastern Canada-Newfoundland Chapter and served as its vice chairman last year.

♦ ♦ ♦

C. H. Moore has been appointed representative in the New Jersey and Pennsylvania territory of the Buckeye Products Co., Cincinnati, handling the company's line of core oils. Mr. Moore attended College of the City of New York, and is well known to the foundry industry in the East, where he has spent the last 10 years.

♦ ♦ ♦

Harold H. Judson, until recently foundry superintendent, Standard Foundry Co., Worcester, Mass., has been appointed foundry manager of the Lake St. plant of Minneapolis-Moline Power Implement Co., Minneapolis. Mr. Judson, following graduation from Worcester Polytechnic Institute in 1923, was foundry engineer, Riley Stoker Co., Detroit. In 1926 he became associated with Goulds Pumps Inc., Seneca Falls, N. Y., as foundry superintendent, where he remained until 1946, when he joined Standard Foundry Co. Mr. Judson has just completed his third year as a national director of the AFA.

♦ ♦ ♦

Raymond A. Quadt has been appointed assistant manager of the General Alumnium Department of Federated Metals Division, American Smelting & Refining Co., New York. Mr. Quadt, who joined the company in 1942 as assistant research metallurgist, has been in charge of all Federated aluminum research operations at the Central Research Laboratories of the parent company, at Barber, N. J., under the direction of Dr. A. J. Phillips. In his new position, in addition to new administrative duties, he will continue in the research and sales engineering activities of his former work. His headquarters will be at the executive office in New York. Mr. Quadt is an active member of the American Foundrymen's Association.

♦ ♦ ♦

Raymond E. Valentine has been appointed district sales manager in the St. Louis office of National Malleable & Steel Castings Co., Cleveland, succeeding **John H. Jaschka,** who has retired following 47 years of service with the company. **Howard Stark,** field engineer in the Chicago office, has been named assistant district sales manager there. Mr. Valentine joined the company in 1913. During World War II he served as chief of the malleable iron section, Forgings and Castings Branch, War Production Board, Washington. Mr. Stark has been associated with the company since 1920, and served as chief inspector at the company's Toledo, O., and Chicago plants until his appointment as field engineer in the Chicago district sales office in 1945.

♦ ♦ ♦

Harry L. Showalter Jr., for a number of years prominent in the basic metal working industry, has announced the forming of his own company, Girard Associates, with principal offices in Philadelphia and Chambersburg, Pa. The company, which was established last year, specializes in sales and engineering related primarily to the forge and press shop field, and represents manufacturers of hammers and presses of all types, heat treating and vibration control equipment.

♦ ♦ ♦

A. B. Muskett has been appointed vice president in charge of manufacturing, General Electric X-Ray Corp., Milwaukee. **R. R. Roberts** has been named administrative assistant to John H. Smith, executive vice president. **Adolph Rebensburg** has been appointed administrative assistant, and **E. Dale Trout,** technical assistant, to R. L. Lefevre, marketing manager.

♦ ♦ ♦

Wendell G. Fogg, since 1924 chief chemist, Air Reduction Sales Co., New York, has been appointed executive engineer, as assistant to Morrough P. O'Brien, director of research and engineering. Mr. Fogg was graduated from Columbia University, and joined Air Reduction in 1918, as assistant research chemical engineer.

♦ ♦ ♦

H. J. Rorke, manager of the Ohio territory of Corn Products Sales Co., New York, has retired. Mr. Rorke joined Corn Products Refining Co., New York, the parent company, when it was organized in 1906. **C. J. Wor-**

(*Continued on page* 110)

O. L. VOISARD

C. H. MOORE

HAROLD H. JUDSON

RAYMOND A. QUADT

Burned-out cores that collapse like a house of cards

Krause Cereal Binders—TRUSCOR (light weight) and AMERIKOR (heavy weight) contribute green strength to the core before baking, dry strength to the core after baking, and collapsibility to the core after casting.

Both cereal binders develop a strong affinity between the sand granuals — guaranteeing excellent green strength — while at the same time permitting the sand mix to flow freely and quickly into the smallest and most remote part of the core box or pattern.

Then when a Krause cereal binder core is placed in the mold and the casting is being poured — this same cereal binder burns out rapidly and completely, insuring ready collapsibility and easy shake out.

So why not take advantage of all these benefits by placing your next order for cereal binder with one of the distributors listed below, or with us direct.

CHAS. A. KRAUSE MILLING CO., MILWAUKEE 1, WIS.
World's Largest Millers of Dry Corn

Truscor (Light Weight) **AND Amerikor** (Heavy Weight)

CEREAL BINDERS

DISTRIBUTORS

M. A. Bell Co., 3430 Brighton Blvd., Denver, Colo.
M. A. Bell Co., 401 Velasco St. Houston, Texas
M. A. Bell Co., St. Louis 2, Mo.
A. L. Cavedo & Son, Inc. Richmond 21, Va.
Foundry Supplies Co. Chicago 16, Ill.
J. H. Hatten, Lansdowne, Pa.
Independent Foundry Supply Co., Los Angeles 11, Calif.
Joseph B. Meier, 96 N. 18th St., East Orange, N. J.
Marthens & Co., Moline, Ill.
Carl F. Miller & Co. Seattle 4, Wash.
Milwaukee Chaplet & Mfg. Co., Milwaukee 4, Wis.
Pacific Graphite Works Oakland 8, Calif.
Porter-Warner Chattanooga 2, Tenn.
Smith-Sharpe Co. Minneapolis 14, Minn.
Frederic B. Stevens, Inc. Buffalo 12, N. Y.
Frederic B. Stevens, Inc. Cleveland 14, Ohio
Frederic B. Stevens, Inc. Detroit 26, Mich.
Western Industrial Supply Co. 208 S. E. Hawthorne Blvd. Portland 14, Oregon

(*Continued from page* 108)

rall, formerly manager at Atlanta, succeeds him as manager in Ohio. Mr. Worrall joined the New York office in 1915, became assistant manager in Baltimore in 1922, manager of the Albany, N. Y. office in 1934, and manager in Atlanta in 1937. **W. H. Adcock** who became associated with the company in 1936, as a bulk salesman, has been appointed manager in Atlanta.

♦ ♦ ♦

Raymond H. Schaefer has been appointed director of research and development, American Brake Shoe Co., New York. Mr. Schaefer was graduated from Carnegie Institute of Technology in 1934 and joined the American Manganese Steel Division of the company in 1940, as assistant foundry metallurgist. He became chief metallurgist in charge of metallurgical research and the company's experimental foundry at Mahwah, N. J., in 1945.

♦ ♦ ♦

Paul Y. Duffee has been appointed chief engineer, McConway & Torley Corp., Pittsburgh. Mr. Duffee was graduated from Carnegie Institute of Technology and served for 16 years as a research development engineer at the Lima and Springfield, O., plants of Ohio Steel Foundry Co. Prior to joining McConway & Torley he operated the Duffee Engineering Service, Houston, Tex., a consulting and sales organization which specialized in the development of machine shop facilities and design of high pressure refining equipment for the petroleum industry.

♦ ♦ ♦

Merle K. Rush has been appointed sales representative in the Omaha, Nebr., territory of American Air Filter Co. Inc., Louisville. Following graduation from Purdue University, Mr. Rush joined American Air Filter Co. in 1934, and spent a year in a special laboratory training course. He spent three years with Independent Air Filter Co. as an engineer and when that company was consolidated with American Air Filter Co. in 1938, he returned to Louisville and was active in the development of the electromatic electronic precipitator. In 1941 he joined the Army and was discharged with the rank of major after three years of action in Europe. Prior to forming the Rush Co. of Omaha, he was associated with Hucker Sales Co., Philadelphia representative of American Air Filter Co.

♦ ♦ ♦

Franklin F. Bogardus, district sales manager for Roots-Connersville Blower Corp., Connersville, Ind., has opened an office at 2306 East 22nd St., Plymouth Bldg., Cleveland, and will cover about the same territory previously handled from the factory. Mr. Bogardus joined the company at the Connervsille plant in 1924, following graduation from Rose Polytechnic Institute, and was in charge of meter engineering and sales for many years. Roots-Connersville is affiliated with Dresser Industries Inc., Cleveland.

♦ ♦ ♦

Charles H. Halford has been appointed export sales manager, Harbison-Walker Refractories Co., Pittsburgh, with headquarters in New York. Mr. Halford became associated with the company in 1933, and has served in the sales departments of the Cleveland and Buffalo offices. In 1947 he was transferred to the New York office as assistant export sales manager.

♦ ♦ ♦

Arthur J. Wieland, executive vice president, Willys-Overland Motors, Toledo, O., has been elected chairman of the board of directors, Wilson Foundry & Machine Co., Pontiac, Mich., its wholly owned subsidiary, succeeding the late Hiram J. Leonard. Mr. Wieland was formerly vice chairman of the board at Wilson. Other members of the board include **George D. Pence,** president; **George L. Palmer,** Willys-Overland treasurer; and **Milton McCreery,** secretary of Willys-Overland.

♦ ♦ ♦

C. G. Raible has been elected president of the Fanner Mfg. Co., Cleveland, succeeding his father, the late **J. R. Raible.** Other new officers elected recently include: **H. J. Colby,** executive vice president and treasurer; **J. E. O'Brien,** vice president and director of purchases, and **Miss Florence Birnbaum,** secretary and assistant treasurer.

♦ ♦ ♦

Charles W. Mackett, formerly assistant sales manager, Hewitt Rubber Division, Hewitt-Robins Inc., Buffalo, has been appointed manager of sales operations. Mr. Mackett joined the Chicago office of the company 32 years ago and has served in various sales capacities.

♦ ♦ ♦

Perry Standridge has been appointed supervisor of the industrial engineering department, Central Foundry Co., Holt, Ala. **K. P. Efird** has been appointed chief metallurgist.

♦ ♦ ♦

Roy Garrison, vice president and works manager, Adirondack Foundries & Steel Inc., Watervliet, N. Y., recently was elected a director of the company.

♦ ♦ ♦

William W. Criswell Jr., has been appointed sales representative with offices in New York for the American Wheelabrator & Equipment Corp., Mishawaka, Ind. Mr. Criswell, a graduate of Massachusetts Institute of Technology, has been associated

(*Concluded on page* 113)

RAYMOND H. SCHAEFER

PAUL Y. DUFFEE

MERLE K. RUSH

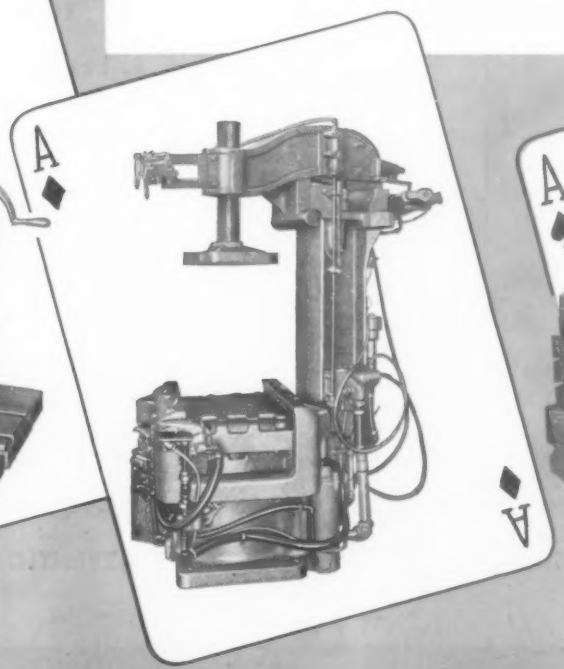
FRANKLIN F. BOGARDUS

4 Aces For FOUNDRIES!

MILWAUKEE CORE GRINDER—Rotary Table Model with 30" grinding wheel, for continuous or intermittent grinding. Dual Table style with 42" grinding wheel, also available.

Here they are — Milwaukee Core Grinder, Core Blower, Molder and Briquetting Press—just the machines you need for your foundry. You'll find their performance outstanding . . . PROFITABLE! For Milwaukee machines rate ace-high in foundries all over the nation. Designed, built and serviced by Milwaukee engineers . . . all practical, seasoned foundrymen . . . these sturdy machines incorporate the latest engineering features . . . every one time-tested . . . features that give you the utmost in speed, safety and efficiency. Write today for literature.

MILWAUKEE - TACCONE CORE BLOWER—Bench style, explosion type, with 30% more blow pressure. Blows cores up to 4 lbs. in weight. All types of blow heads.



MILWAUKEE JOLT SQUEEZE RAIL STRIPPER—Arm type with 20" frame opening. Handles flasks up to 1000 sq. in. Also Jolt Squeezers, Pin Lifters, Strippers and Roll-off machines.

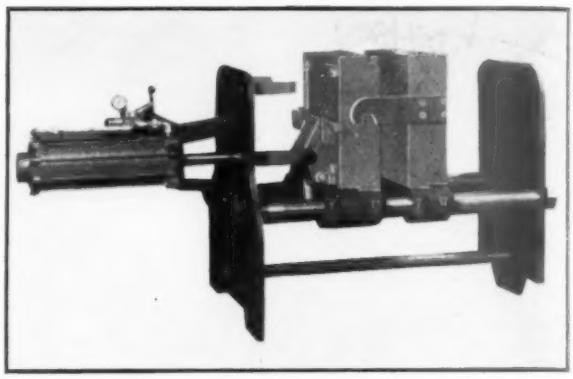
MILWAUKEE BRIQUETTING PRESS — Hydraulic type with capacity up to 4 tons of briquettes per hour. Converts low grade borings and turnings into ideal scrap.

MILWAUKEE Foundry Equipment Co.

3238 W. PIERCE STREET, MILWAUKEE 4, WISCONSIN, U.S.A.

Attention!

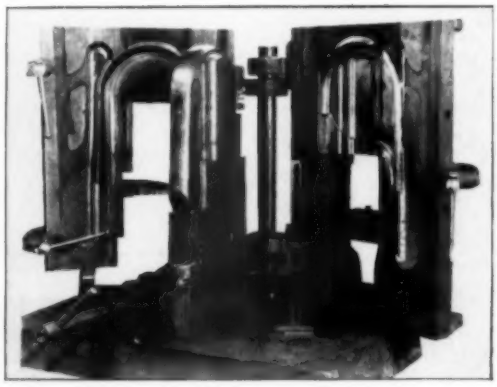
Buyers of Aluminum Castings



HAVE YOU CHECKED THE ADVANTAGES of the PERMANENT MOLD SYSTEM?

For suitable production castings, pneumatic permanent mold equipment gives you greater economy and speeds production. Another advantage of this kind of mold equipment is that the interchangeable custom built mold blocks can be quickly and easily bolted to this pneumatic table. The table itself is durable and simple in design and can be used continuously.

1. **More economical on production items.**
2. **Greater production.**
3. **Improved casting quality.**
4. **Smoother and more attractive appearance.**
5. **Closer dimensional tolerance.**
6. **Less polishing and machining.**



For larger and more complicated types of castings the manually operated mold is most economical.

The permanent mold system of making aluminum castings is rapidly becoming more popular because of these advantages. Modernize your equipment by converting to permanent molds and using our pneumatic draw tables.

It is of utmost importance to have your permanent molds accurately and properly designed to suit the requirements of your foundry. This will enable them to produce castings with a minimum amount of effort and expense. The initial cost of this type of PROVEN AND DEPENDABLE mold equipment is quickly amortized in more efficient production.

SEND US YOUR BLUEPRINTS OR SAMPLE CASTINGS FOR QUOTATION.

YOUR INQUIRY WILL RECEIVE IMMEDIATE ATTENTION.

MASTER PATTERN COMPANY

1315 MAIN AVENUE — CLEVELAND 13, OHIO

DESIGNERS AND MANUFACTURERS OF PERMANENT MOLDS, WOOD AND METAL PATTERNS AND MODELS

(*Concluded from page* 110)

with the Rochester & Pittsburgh Coal Co., in a development and sales engineering capacity, and prior to that with Combustion Engineering Corp., New York.

♦ ♦ ♦

R. L. Cunningham, executive vice president, has been elected president, Ohio Ferro-Alloys Corp., Canton, O., succeeding the late L. G. Pritz, founder of the company. Mr. Cunningham, a director of the corporation, has been one of its officers since 1941. **W. W. Pritz,** son of the late L. G. Pritz, succeeds Mr. Cunningham as executive vice president. Mr. Pritz, also a director, joined the corporation in 1939 and has served as works manager and vice president. **J. C. Vignos,** who has been re-elected vice president in charge of sales, has been with the company for 14 years. He was previously research director and general sales manager. **W. O. Wetherell** has been named secretary-treasurer, succeeding **H. G. Paisley,** who has retired. Mr. Wetherell joined the corporation in 1935 and has served as traffic manager and purchasing agent.

♦ ♦ ♦

J. C. Duke has been elected vice president in charge of the 3M Coated Abrasives Division, Minnesota Mining & Mfg. Co., St. Paul. Mr. Duke became associated with the company in 1921, and has been sales manager for its surface-coated abrasive paper and cloth, including products for metalworking and woodworking industries.

♦ ♦ ♦

George W. Crowl has resigned as assistant manager, pig iron sales, American Steel & Wire Co., Cleveland, and has moved to California. Mr. Crowl joined the Corrigan-McKinney Steel Co. office in Pittsburgh, in 1908, as a pig iron salesman, remaining with that company until 1935 when the late J. S. McKesson assumed the selling agency of pig iron for Carnegie-Illinois Steel Corp., and later for American Steel & Wire Co. In 1945, when American Steel & Wire Co. took over direct sales of its merchant pig iron, Mr. Crowl was appointed assistant manager at Cleveland.

♦ ♦ ♦

John B. Girdler, assistant general manager of sales, Vanadium Corp. of America, New York, has been appointed manager of the Pittsburgh sales district, succeeding the late G. A. Fritschi. Mr. Girdler's headquarters will be in the Oliver building, Pittsburgh. **Raymond H. Filsinger Jr.** has been appointed eastern sales representative of the corporation with headquarters in the New York offices.

♦ ♦ ♦

J. I. Hammond has been appointed sales representative of the central Pennsylvania territory of Osborn Mfg. Co.'s Brush Division, Cleveland, assigned to the area between Reading and Altoona. **E. M. Schoemmell Jr.,** has been assigned to the territory including Maryland, Virginia, North and South Carolina, and Washington, D. C., as sales representative.

♦ ♦ ♦

Dr. D. P. Morgan has been appointed administrator of research and development, Mathieson Chemical Corp., New York, formerly the Mathieson Alkali Works. For the last two years Dr. Morgan was associated with W. R. Grace & Co., New York, in research and development work.

♦ ♦ ♦

Littleton C. Barkley has been appointed general sales manager, West Coast Division, Raybestos-Manhattan Inc., Passaic, N. J. Mr. Barkley will supervise sales of the Manhattan Rubber, Asbestos Textile and Packing and Equipment Sales Divisions of the corporation. He has been associated with the Manhattan Rubber Division for 23 years, recently as sales manager for mechanical rubber products on the Pacific coast and prior to that as manager of its New York branch.

♦ ♦ ♦

J. Charles Bullock has been appointed district sales manager of the Albany, N. Y., office, recently opened by Link-Belt Co., Chicago. Since the first of the year Mr. Bullock had been district sales manager of the Schenectady, N. Y., office, which was discontinued recently. He entered the company's Dodge plant in Indianapolis, in 1935, was district sales engineer at the Ewart plant there from 1942-45, and district sales engineer at the Atlanta plant from 1945 until his transfer to Schenectady this year.

♦ ♦ ♦

Ray F. Frings has been appointed sales representative for Harry G. Mouat, equipment manufacturer's representative, Birmingham. For the last 4 years Mr. Frings has been chief metallurgist and supervisor of the industrial engineering department, Central Foundry Co., Holt, Ala.

♦ ♦ ♦

George A. Meyer has been appointed vice president in charge of the Diecasting Division, Hamilton Art Metal Corp., New Hyde Park, N. Y. Mr. Meyer has been associated with the diecasting industry for 33 years.

♦ ♦ ♦

Harry E. Thiele has been elected vice president of manufacturing, General Steel Castings Corp., Eddystone, Pa., succeeding A. R. Allard, resigned.

♦ ♦ ♦

Philip A. Bohlander has been appointed assistant works manager, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

J. C. VIGNOS

W. W. PRITZ

R. L. CUNNINGHAM

J. C. DUKE

FOUNDRY Developments

By EDWIN BREMER

INVESTIGATION by Wozny and LaGrelius, of welding plain carbon steel castings, results of which were presented in a paper before the annual meeting of AFA, shows that organic coated electrodes are not suitable for repair welding due to their tendency to produce pinhole porosity. However, lime or mineral coated electrodes generally produce welds free from that trouble. Tempering of welds in plain carbon steel has only a slight effect on hardness of the weld metal or the structure of the heat-affected zone. From the standpoint of hardness and microstructure, minor welds in plain carbon steel are just as critical or more critical than major welds. Plain carbon steel can be welded safely without any preheating up to 2-in. sections.

• • •

MEDINA Iron & Brass Co., Medina, N. Y., recently claimed that it is the first foundry in the country to cast aluminum soil pipe and fittings successfully, and it is expected that the new product will supplement available supply.

• • •

CHANGES to bring the American Standard Safety Code for Use, Care, and Protection of Abrasive Wheels (B7.1-1947) into line with current practice have been made in the new edition which was approved recently by the American Standards Association, 70 East 45-th St., New York 17. Slightly higher speeds for types 12 (dish wheels) and 13 (saucer wheels) are now permitted. Rule governing minimum spindle diameters for various sizes of wheels has been changed to advisory rather than mandatory. Appendix includes a set of sketches with notes describing most common causes of failure of threaded hole wheels of cone or plug types, and descriptions of an adapter type mounting for cup wheels on portable grinders, and of rubber faced protection washers.

• • •

IN a test run of 34 heats of 0.04 to 0.07 per cent C rimmed and mechanical capped grades of steel, Oscar Pearson, Carnegie-Illinois Steel Corp., Gary, Ill., reported at the recent Electric Furnace Steel Conference that a 9.6 per cent reduction in charge to tap time was obtained by use of compressed air injected into the molten steel bath. Air was injected under 48 psi through 1-in. extra heavy steel pipe with two 20-ft lengths consumed per heat. Ore additions were made at normal time intervals, and practice was to insert first lance at approximately 0.18 per cent C, usually immediately following ore addition.

• • •

SPECIAL bibliography listing 1200 reports based on investigations and evaluations of German scientific, technical and industrial intelligence by American investigators under the direction of the Field Information Agency, Technical (FIAT) is now on sale by the Office of Technical Services, Department of Commerce. Publication, entitled "PB-86000, FIAT Reports. A Bibliography and Index of Reports on German Industry," sells for $5, and is divided into three parts listing reports by FIAT numbers correlated with PB numbers, a cross reference in PB numbers corresponding FIAT numbers, and an author and subject index.

• • •

FOLLOWING a study of solidification characteristics of gray iron by bleeding partially solidified castings and obtaining cooling curves, J. E. Fifield and J. H. Schaum concluded in a paper presented at the recent AFA convention that: Rate of solidification in a given section size varies inversely with the temperature above solidification temperature at which the metal is poured, and increases with decrease in cross-sectional area. Rate of solidification varies with chemistry; up to the eutectic composition, the higher the carbon, the lower the rate. Gray iron acts essentially as a solid after its temperature falls slightly below the liquidus; the tightly interlaced dendrites are able to hold their shape and support considerable weight of liquid metal. Blind risers do not function effectively on gray iron because of its weak skin strength.

• • •

EFFECT of homogenization heat treatment on light-wall cast steel sections as determined by notched-bar impact properties at normal and low temperature, end-quench hardenability, time-temperature-transformation studies, and microstructure analyses led the Steel Founders' Society of America to the following major conclusions: Homogenization heat treatments employing high heat treating temperatures or long heating times at normal heat treating temperatures are not effective in improving the impact and hardenability properties of cast steels. Effect of time of heating at the homogenizing temperature beyond a reasonable minimum period is negligible. Effect of increasing homogenization temperature above 1650° F is detrimental for a cast steel if a normalizing or a normalizing and tempering heat treatment is used. Detrimental effect has been shown to be primarily a result of grain coarsening incident to homogenization. Hence, specification of high temperature or extra-long homogenization heat treatments by the consumer should be discouraged.

• • •

MOLD Surface Committee of AFA, J. B. Caine, chairman, reporting on "Changes in Chemistry of Liquid Steel in Contact with Sand" found that the steel surface in contact with the sand always showed an oxidized and decarburized area or skin, and further states "The steel foundryman has always recoiled instinctively from the thought of carbon in any form in his sand. . . . If carbon in any form is ever found to have possibilities in improving the behavior of steel foundry sands when in contact with liquid steel, the mythical danger of carbon pickup should not discourage the thorough investigation of this type of addition. Some carbon pickup from the sand will be advantageous."

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Logan Dust-Protected Bearing—*ideal for use where dust, sand, iron filings, or scale are present. Note steel labyrinth seal, (1) the design of which tends to make it self-cleaning, i.e., dust which may drift in, is thrown out as the roll revolves. Entire bearing assembly is set back from end of roll, in protected position. This protected bearing revolves just as freely as a plain bearing because it has no felt washers. Outer shield, (2) which is fixed to the stationary inner race of bearing, does not touch any rotating part. The Dust-Protected Bearing is a patented Logan construction.*

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TECHNICAL REPORTS

(*Continued from page* 97)

Considerable time was devoted to the subject of fatigue allowances, which was introduced by Mr. Annich while questions were being accumulated for the panel. Formulas for fatigue allowance are derived from standard data compiled from time studies of each individual job, breaking down each job into its elements. The fatigue factor is based on the particular job a man is doing.

Mr. Van Order described method of taking a time study on a molding operation. He suggested making five time studies from different phases of the operation, one from beginning to end, from end to beginning, from the middle third, etc. Conditions under which the men work should be explored. As many details of operations as are available should be accumulated. All unnecessary steps must be added to the fatigue figure. After breaking down the operation by elements, the fatigue standard is built from the information tabulated.

When asked how many time studies are necessary to set up a standard it was stated that twenty are not too many for a long production job, while four might be sufficient for a small one. It was emphasized that it is useless to set any standard from one time study. They should be taken at different times of the day and during different phases of the operation. Thus, individual parts of the operation are caught and broken down into work elements.

In setting a standard on a two-man operation, where one operation takes longer than another, the standard should be set on the longer of the two. It was suggested if one operator has a longer cycle than another, the men should be alternated, or allowed to even up the work themselves.

Piece work and incentive systems were compared. Mr. Annich explained the difference by stating that on a piece work system an agreed rate is paid for each casting or piece produced. Under an incentive system a definite number have to be produced each hour to earn the base rate.

REFRACTORY TESTING, USE

Are Discussion Subjects

FIRST technical session sponsored by the Refractories Committee had R. H. Stone, Vesuvius Crucible Co., Swissvale, Pittsburgh, presiding, and A. S. Klopf, Western Foundry Co., Chicago, acting as co-chairman.

S. M. Swain, North American Refractories Co., Cleveland, in his paper, "Testing Refractories for the Foundry," outlined the careful planning, selection of objectives, justification of costs and safety factors required for a testing program. Detailed recommendations were made for sampling brick and other refractory materials. Descriptions of testing were given for refractoriness, reheating changes, strength, load bearing ability, spalling, porosity, water absorption, specific gravity, bulk density, chemical analysis, size, thermal conductivity and slagging of fire brick. Testing for refractoriness, screen analysis, bonding strength and consistency of mortars was described, as well as refractoriness, spalling, workability index and firing shrinkage of plastic refractories.

Slides were used to show method of sampling brick in a pile, method of mounting test cones in determining the pyrometric cone equivalent, the standard test for refractoriness, and appearance of cones after testing was illustrated. Other illustrations included lever-type load test furnace, spalling panel frame and brickwork, spalling equipment for panel spalling test, measuring wedge and its use in measuring warpage, diagram of essential parts of thermal conductivity apparatus, apparatus for measuring consistency of refractory mortars, arrangement for measuring water retention and apparatus for workability index test.

In the discussion following the paper, directed by Co-chairman Klopf, the question of specific heat was introduced, as no test of this nature had been mentioned in the paper. Mr. Swain said service conditions differ in each plant and have to be worked out individually. He also described how the pyrometric cones were made for the pyrometric equivalent test.

The second paper, by W. H. Owen, Harbison-Walker Refractories Co., Pittsburgh, was a "Review of Refractories Used in Steel and Iron Foundries." Mr. Owen discussed well known refractories and special refractories, including gate and runner brick, breaker core shapes for necked-down risers, and cup and gate strainer core shapes.

In open hearth and electric furnaces, and converters, refractories employed must serve in the processing of more than one charge. The speaker discussed the use of silica brick for roofs and sidewall construction, for hard continuous operation. Considerable progress has been made in development of bottom materials for furnaces. In acid electric furnaces careful attention to proportioning of clay and ganister must be given as well as sizing of the ganister. Introduction of rammed magnesite materials has afforded means of rapid installation of basic furnace bottoms.

In the cupola, fireclay refractories especially manufactured for the purpose are used, as well as super-duty fireclay brick, silica and high-alumina brick. Refractory materials are used in ladles for transporting molten metal from furnace to mold, and linings of larger units are constructed of fireclay brick. Smaller ladles frequently are lined with rammed material forming a monolithic lining.

Use Gate and Runner Brick

Gate and runner brick are often used to avoid erosion of the mold and the gate by liquid metal. Gate and runner brick with slip joint ends to assure a better seal between gate sections are available, and their use will keep mold erosion to a minimum. Refractory breaker core shapes have been developed which permit the use of either square or round risers. These were illustrated by slides. In the application of refractories to necked-down riser cores the breaker core shapes are power pressed from a clay mixture designed for the core to withstand high thermal shock.

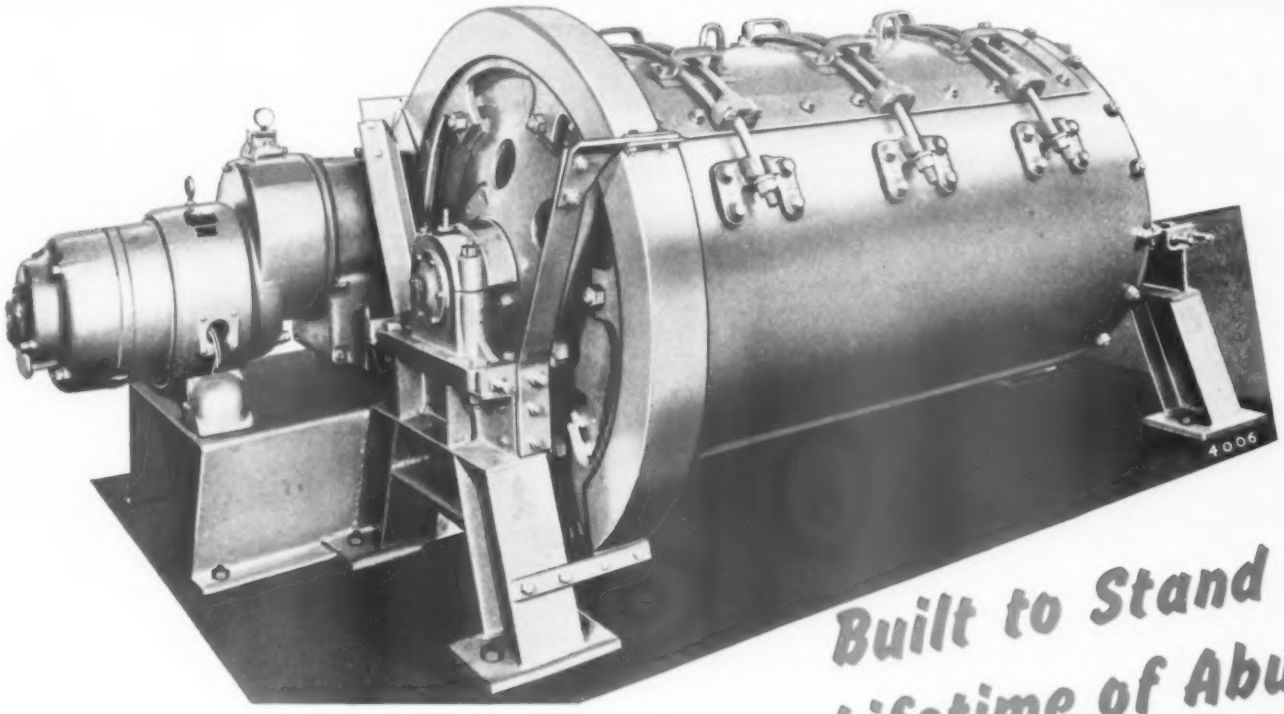
Refractory cores come ready for use. Preparation of coreboxes and sand and use of core binders and molders' time is eliminated in the production of necked-down riser cores, now made in the foundry. The speaker also described the cup and gate strainer core shapes which act as a choke in the gate system so as to float undesirable materials in a reservoir accumulating above the core, permitting clean metal to enter the mold. The AFA Core Committee has been solicited toward standardization of these shapes, and a range of core sizes predicated on a range in the rate of delivery of metal through the core to the mold has been submitted for study and suggestions. If standardization may be accomplished a basis for manufacturing these shapes in refractory material at low cost will be provided.

The second of two refractories sessions was conducted as an "Information Please", or question and answer panel. Arthur S. Klopf, Western

(*Continued on page* 118)

SLY TUMBLING MILLS

THE STANDARD OF STURDINESS



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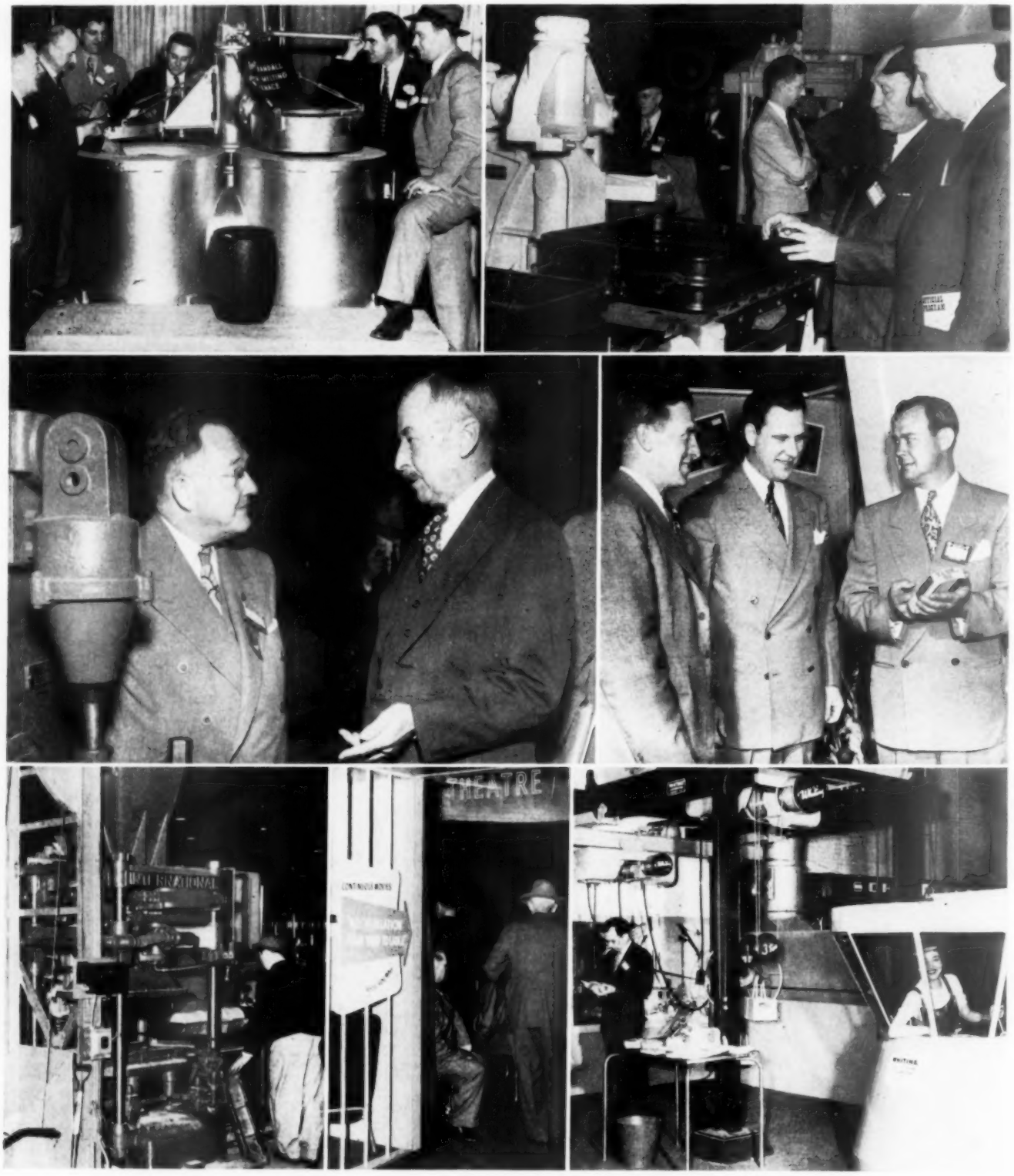
(*Continued from page* 116)

Foundry Co., Chicago, presided.

Six well known refractories experts constituted the panel, as follows: R. H. Zoller, Zoller Casting Co., Bettsville, O.; E. C. Bales, Ironton Fire Brick Co., Ironton, O.; R. P. Schauss, Illinois Clay Products Co., Chicago; Richard H. Stone, Vesuvius Crucible Co., Swissvale, Pa.; W. H. Owen, Harbison-Walker Refractories Co., Pittsburgh; and Ray A. Witschey, A. P. Green Fire Brick Co., Chicago.

By way of introduction, Chairman Klopf reminded the audience that there would have been no refractories meeting held if nature had not endowed the human race with abundant supply of refractory materials capable of withstanding heat and thereby making metallurgical operations possible. He also pointed out that all too frequently men are not properly trained to prepare refractory materials for use in the foundry and

(*Continued on page* 120)



Typical scenes at the AFA Foundry Show in Philadelphia. Center row, left, shows the new AFA president-elect, William B. Wallis, president, Pittsburgh Lectromelt Furnace Corp., chatting with F. R. Wallace, president, Tabor Mfg. Co.

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(*Continued from page* 118)
that for this reason service life is not equal to that which the materials are capable of yielding. The time must come, he warned, when foundries must devote to their refractories the same attention and interest they give to other operations, such as melting practice.

Considerable discussion revolved around monolithic linings for cupolas and ladles. The materials from which such linings are made must by necessity be high grade and properly prepared and applied. Monolithic linings usually are utilized in repair and maintenance, but they are now being found to have possibilities in original linings. One commentator mentioned that one foundry using monolithic linings as original installations in cupolas is finding they provide service life that is almost double previous practice.

Among other topics considered by the panel and members of the audience, were special shapes, such as ladle bottoms, spout linings, tap hole brick, and the like. An advantage of using a disk shape as a ladle bottom is that it speeds relining, gives a dry bottom and reduces drying time. This type of bottom is becoming more popular.

SIX GRAY IRON SESSIONS

Treat Variety of Subjects

FIRST of the six sessions sponsored by the Gray Iron Division had the stage set by R. G. McElwee, iron foundry division manager, Vanadium Corp. of America, Detroit, who reported upon the "Relation of Cupola Research to Progress in Cast Iron Development." V. A. Crosby, Climax Molybdenum Co., Detroit, presided as chairman, and was assisted by D. E. Krause, Gray Iron Research Institute, Columbus, O.

Mr. McElwee, who is chairman of the AFA Cupola Research Committee, declared that the Cupola Handbook has proved to be a valuable work and is now being revised. He called attention, however, to the fact that many foundries are operating cupolas without following the recommendations—notably as to coke and air. The committee is now investigating the effect of coking time on quality of coke, but the report has been delayed.

It had been hoped to report on use of oxygen in the cupola. Experimental work has been done and the data tabulated, but the report has been delayed unavoidably. The speaker also said that the committee is not ready to make a recommendation concerning use of anthracite coal in the cupola, although some foundries are utilizing the fuel with good results.

Considerable discussion was sparked by a paper, "A Suggested Method for the Determination of Coke Reactivity to Carbon Dioxide at Combustion Temperatures," contributed by H. Edward Flanders, department of metallurgy, University of Utah, Salt Lake City, Utah.

To determine the fundamental differences between good and bad cokes, the author proposed a method of determining the rate of reaction of coke to carbon dioxide at the temperatures existing in cupola combustion. It is based on the analysis of combustion gases as a column of coke burns as nearly adiabatically as possible. From the relation of composition to the height of the coke column the rate of the reaction can be approximately calculated and the coke reactivity to carbon dioxide then is estimated as a function of temperature.

In the summary, Mr. Flanders said that "while the test may give values which are but approximately true, it is expected that the errors involved in the assumptions will be common under standardized conditions of test, and the results will be of the proper relative order. The assumption that the properties of coke are constant under combustion conditions seems rather insecure. On the other hand, it is expected that cokes do differ in this respect and that this difference will give an excellent measure of the ability of the coke to give a high temperature at a suitably positioned melting zone in a cupola."

In the effort to "pinpoint" attention of castings designers to understand the thermal behavior of gray iron in large sections, E. Longden, works manager, P. R. Jackson & Co. Ltd., Manchester, England, presented a detailed analysis of contraction and distortion in such castings, suggesting ways to lessen distortion and methods to observe its degree. His address constituted the official exchange paper of the Institute of British Foundrymen, being heard Thursday morning by an audience of about 125. Chairman of the session was A. E. Schuh, U. S. Pipe & Foundry Co., Burlington, N. J.; co-chairman F. G. Sefing, International Nickel Co., New York.

Most of the author's tests were made without correlating temperature with the thermal behavior of the castings studied. The latter included machine tool beds, boring bars and gear blanks. Principal test method involved following the movement of the casting after pouring by frequent measurements between fixed points outside the mold and rods held by the metal of the casting. Eight or more such check points were established and a record kept over a period of days.

The amount of contraction and degree of final distortion was found to depend upon the design and its relationship to the physical and mechanical properties of the alloy and the influences inherent in manufacturing methods such as design section and volume of the casting; class of alloy; melting influences on the alloy, superheat and pouring temperature; size shape and location of the runner and riser gates and feeder heads; character of the mold and core materials; method of making mold and cores; and stress relief treatment during and after the cooling period.

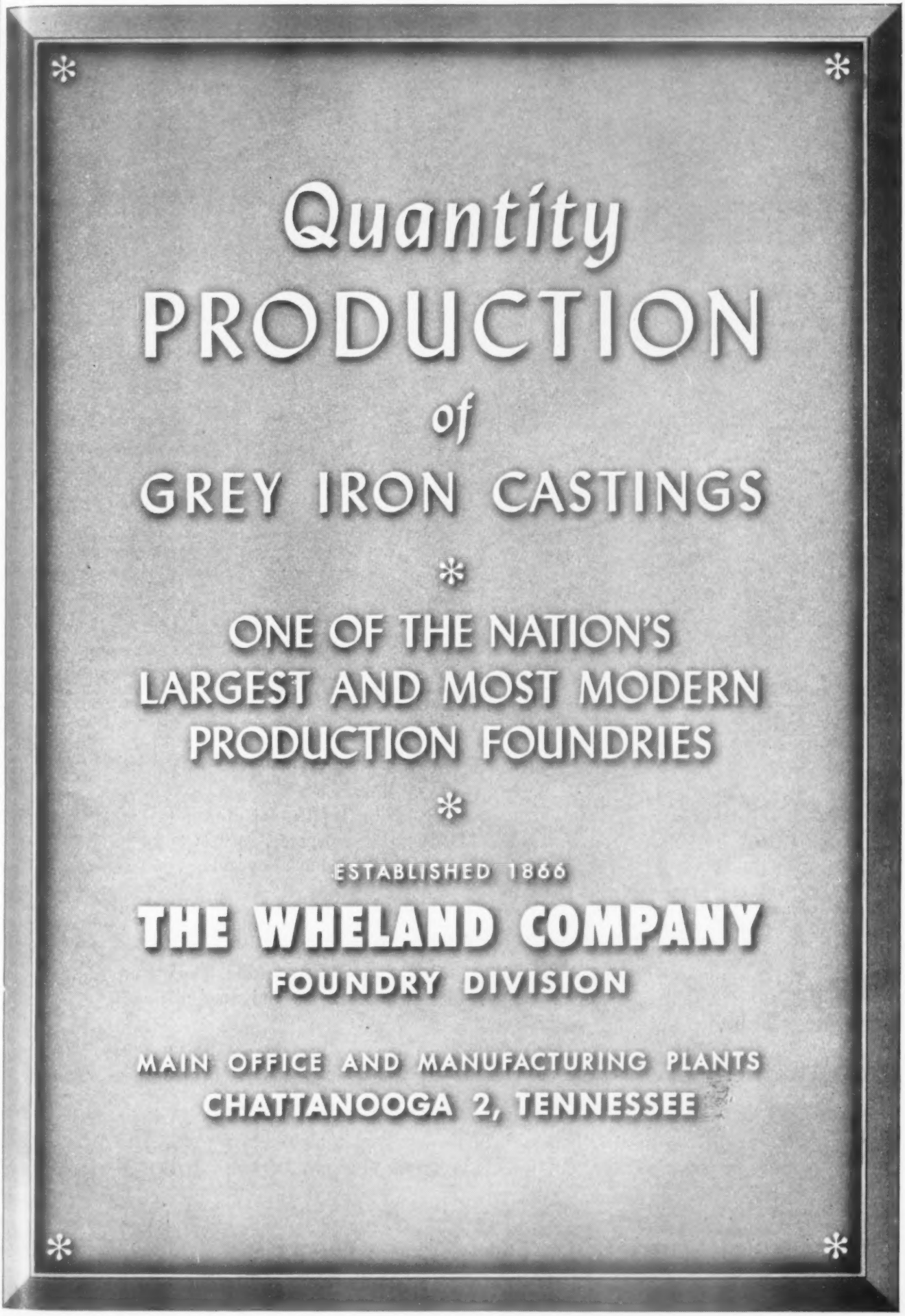
Contraction Rates Vary

Mr. Longden concluded that in gray iron castings of contrasting sections of varied cooling gradients the thicker members contract by a greater percentage than the thinner members, in contrast to what happens when such sections are cast separately. In a composite casting, the light sections are subjected to an extensional stress during cooling of the metal, created by the resistance of the thicker sections which are not yet contracting and actually may be expanding. Air cooling of casting zones with high heat content is of obvious benefit in reducing stresses and camber allowances.

Effect of composition and cross section on mechanical and thermal properties, wear resistance and microstructure of a number of cupola melted cast irons was discussed by Arthur B. Shuck, assistant to the chief metallurgist, Koppers Co. Inc., Piston Ring Division, Baltimore. In the study, test bars, varying in cross section from ¼-in. square to 1½-in. square, were cast horizontally in green sand molds for each of six types of iron included. Several types of carbon-silicon bases, ranging from two to five, were melted in each type of alloy to determine the effect of the content of these elements.

Irons ranged from an alloy-free type on up through nickel-chromium.

(*Continued on page* 123)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(*Continued from page* 120)

nickel-molybdenum, chromium-molybdenum, straight molybdenum and nickel - molybdenum - chromium heat treated analysis. They are types which have been used in piston rings, steam packings and pressure seals.

By means of some 128 exceptionally clear photomicrographs the speaker delineated the effects of composition-cross section in a most interesting fashion. He concluded that tensile strength increases with the refinement of the matrix and graphite structure produced by decrease in cross section, and hardness also increases with decreasing section. Elastic modulus increases somewhat in the smaller cross sections. Wear is influenced by microstructure and indirectly by cross section. The nickel-chromium alloy could be cast in a greater range of sections with a uniform pearlitic matrix. The heat treated triple alloy, developed originally to meet requirements for aircraft piston rings, obviously showed superior properties in all respects.

Heat Treat Cast Iron

Two gray iron sessions were devoted to a symposium on heat treatment. One paper on this subject, prepared by R. A. Flinn and R. J. Ely, American Brake Shoe Co., Mahwah, N. J., and presented by Mr. Flinn, was entitled "Gray Iron Hardenability and Its Relation to Air Quenching of Castings." It covered a series of tests on the range of hardenability available in unalloyed and nickel-molybdenum gray iron and the use of hardenability values in planning the quenching of castings.

The authors conclude that properly controlled gray irons have both reproducible hardenability and a wide range of hardenability similar to alloy steels. Furthermore, hardenability may be adjusted by the use of alloys to provide compositions that will harden by air cooling from 1600° F. Cracking and distortion are said to be reduced. The alloyed compositions also may be used for differential hardening by induction or flame heating followed by air cooling.

In another paper, "Stress Relief of Gray Iron Castings," presented by J. H. Schaum, Naval Research Laboratory, Washington, the speaker stated that the expanded use of gray iron for stressed parts has increased the need for stress relief. The report showed results of tests made on castings in the shape of a four-spoked wheel. Specimens were obtained from sand cast ingot, and the metals used were of industrial compositions melted in cupolas. Effects of time and temperature on relief were studied with a relaxation machine developed at the Naval Research Laboratory.

Conclusions reached indicate that alloy irons require higher temperatures and longer time to reach complete relaxation. No correlation was found between residual carbon and the rate of relaxation. The higher the initial stress the faster the rate of relief during the early period of time of relaxation, but the longer the time required to reach a given point of stress relief.

Tests conducted in the relaxation machine showed that below 800° F almost no stresses were relieved. From 800 to 1050° F relief increased, and at 1050° F for 2 hr, wheels were completely relieved. It also was shown that shaking out castings as soon as possible after pouring helps to reduce the degree of stress developed in the castings. The relative importance of furnace versus air cooling after stress relief was established and showed that air cooled wheels have three times as much residual stress.

Other tests conducted by Mr. Schaum disproved the theory that stresses are relieved in castings which are allowed to stand in a storage yard for a period of time. Test castings were allowed to stand in a foundry for a year and a half, at the end of which no difference in stress was noticed. Castings allowed to stand in the yard showed only a very small relief from stress, and this was traced to wide temperature fluctuations.

During the discussion period, R. A. Flinn, American Brake Shoe Co., Mahwah, N. J., differentiated between this test which dealt with grosser stress relief as compared with the use of 300-400° F to relieve stresses in metal structure.

In answer to the question as to why the resultant air cooling didn't build up stresses in castings shaken out early, Mr. Schaum said that he was not sure, but that it could be due to the fact that the casting at this stage is going through a different

INTERESTED SPECTATOR: Young as well as old found much to attract them to the operating exhibits of the recent AFA Foundry Show, as evidenced by this interested spectator watching a demonstration at the Linde Air Products Co. booth

phase of transformation than when air cooled later after stress relief.

At the concluding symposium on heat treatment, G. Lahr, Detroit Diesel Engine Division, General Motors Corp., Detroit, presented his paper, "Conventional vs. Salt Bath Hardening of Cast Iron Cylinder Liners."

Mr. Lahr stated that while hardening of alloy cast iron cylinder liners greatly increases wear resistance and life expectancy, the conventional oil quench and draw methods of hardening present shop problems such as distortion, growth, scaling and cracking. To reduce or eliminate these undesirable features, experiments were made on the adaptation of salt bath quenching to this particular job. Tests were conducted on production line sand cast liners that had been normalized at the foundry.

Test results show that salt bath treatments have advantages over conventional gas furnace heating and arbor quenching in that absence of scale on the liner eliminates blast cleaning. Since no arbor is required, cracks due to stresses imposed by the shrinking of the liner on the arbor are eliminated. Distortion is minimized. and hardening time is reduced considerably.

Study High Phosphorus Irons

At the fifth gray iron session, J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., presided with W. W. Levi, Lynchburg Foundry Co., Radford, Va., as co-chairman. W. W. Austin Jr., Southern Research Institute, Birmingham, presented the first paper, "Improvement of Machinability in High Phosphorus Gray Cast Irons."

The object of Mr. Austin's study was to find a commercially feasible means of overcoming the harmful effects of phosphorus on the machinability of high phosphorus gray iron castings. Particular emphasis was given to cast irons produced from southern ores where the phosphorus content of pig iron ranges between 0.6 and 0.9 per cent.

Three methods were followed in investigating the problem: First, an attempt was made to overcome the abrasiveness of iron phosphide by changing its structure, properties and composition through alloy additions. Second, control of microstructure exclusive of the phosphide constituent was attempted through production of a soft ferritic matrix structure instead of the relatively hard pearlitic matrix normally characteristic of high phosphorus gray irons. Third, the removal of constituents known to have adverse effects on machinability was tried through desulphurization and dephosphorization treatments of the molten iron, and combinations of these treatments with alloy additions.

Results obtained indicate that improvement in machinability of a selected base iron may be attained by a combined treatment involving sodium carbonate desulphurization and zirconium alloy addition. Cost of this treatment is estimated at less than $2.50 per ton of treated iron.

The second paper, "The Production of Nodular Graphite Structure in Gray Cast Iron," was presented by H. Morrogh, British Cast Iron Research Association, Birmingham, England. Results of Mr. Morrogh's investigation show that he has developed a method for producing nodular graphite structures in cast irons without the necessity of heat treatment as in the making of malleable cast iron.

Meeting Calendar

Sept. 23-24-25—National Association of Foremen, 25th anniversary meeting Philadelphia.

Oct. 12-16—American Chemical Society, Chicago Section, Fifth National Chemical Exposition, Chicago Coliseum, Chicago.

Oct. 13-14—Magnesium Association, mid-year meeting, Skytop Club, Skytop, Pa.

Oct. 14-15—Gray Iron Founders Society, annual meeting, Atlantic City, N. J.

Oct. 14-15-16—Foundry Equipment Manufacturers Association, annual meeting, White Sulphur Springs, W. Va.

Oct. 22—Non-Ferrous Founders' Society annual meeting, Philadelphia.

Oct. 25-29—National Metal Congress and Exposition, Philadelphia.

Nov. 4-5—Metals Casting Conference, Purdue University, West Lafayette, Ind.

Nov. 11-13—Meehanite casting manufacturers, annual meeting, Pittsburgh.

Nov. 15-16—Steel Founders' Society of America, fall meeting, Hot Springs, Va.

Nov. 18-19—National Founders Association, annual meeting, Chicago.

May 2-5—American Foundrymen's Society, annual convention, St. Louis.

The process involves the treatment of a low-sulphur hypereutectic cast iron with additions of cerium in the form of misch metal just prior to casting. Cerium performs the functions of a desulphurizer and a carbide stabilizer. When the iron is treated with cerium alone, only the hypereutectic graphite is nodular and the remaining graphite is in a pattern termed "quasi-flake graphite."

The hypereutectic nodules are in the spherulitic form, and nodular cast iron with all of the graphite in this form is obtained by treating the molten metal with cerium, followed by a graphitizing inoculant such as ferrosilicon or silicon-manganese-zirconium. The process is said to be applicable to a wide range of irons and to improve mechanical properties of gray cast iron.

Thomas H. Wickenden, International Nickel Co. Inc., New York, stated in a written discussion of Mr. Morrogh's paper that his company has developed a process for producing spheroidal graphite structure in cast iron. The process is based on the introduction into the iron of small amounts of magnesium or a magnesium-containing addition agent, such as nickel-magnesium alloy. Small additions are effective in reducing the sulphur content, and as additions increase in size spheroidal graphite is produced in increasing amounts until that point is reached when the amount of additive converts all graphite to the spheroidal form.

He went on to say that as the amount of spheroidal graphite is increased in the iron, the strength will increase to a value several times that of the untreated product; impact properties are improved over this range. A low phosphorus iron with the graphite in the fully spheroidal condition will show some elongation in the as-cast condition which can be greatly improved by controlled cooling rate or heat treatment.

During the discussion period, Mr. Morrogh pointed out that holding time in the ladle up to 20 minutes had little effect upon graphitization. Longer holding time actually assists the process, allowing the cerium to take more effect, he pointed out.

When questioned about remelting scrap, he said that all effective cerium is lost by oxidation when cerium treated gray iron is remelted.

With respect to fluidity he stated that the treated iron at a comparable pouring temperature has better fluidity than a low phosphorus iron with 3 per cent carbon and 2 per cent silicon, but has less fluidity than an untreated iron with the same constituents.

No difference in machinability was noted between a treated iron and pearlitic gray iron when the two were used in a production shop working brake drums and cylinder heads.

At the concluding gray iron session Friday 2 p. m., May 7, R. G. McElwee, Vanadium Corp. of America, Detroit, presided, and E. C. Jeter, Ford Motor Co., Dearborn, Mich., was co-chairman. W. C. Wick, Armour Research Foundation, Chicago, in a paper entitled, "Oxygen Enriched Cupola Blast," presented results of a research project sponsored by Whiting Corp., Harvey, Ill., at Armour Research Foundation, to determine the advantages or disadvantages that would be obtained from using oxygen enriched air blasts in the cupola. This project was described

(*Continued on page* 126)

Redford CORE BLOWER CARTRIDGE TYPE

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(*Continued from page* 124)
in detail in THE FOUNDRY, June, p. 16.

The second paper, "Solidification Characteristics of Gray Iron," by J. H. Schaum, National Bureau of Standards, Washington, and J. E. Fifield, International Nickel Co., Hartford, Conn., was read by Mr. Fifield. Solidification studies described were conducted by (1) bleeding partially solidified gray iron castings and (2) obtaining cooling curves at various points within castings which were identical to the bled castings and which were poured simultaneously but allowed to solidify completely.

Conclusions as a result of the studies proved: Rate of solidification of gray iron in a given section size varies inversely with temperature above solidification temperature at which the metal is poured. Rate of solidification increases with decrease in cross-sectional area. Rate of solidification varies with chemistry; up to the eutectic composition, the higher the carbon, the lower the rate. Cast iron acts essentially as a solid after its temperature falls slightly below the liquidus; the tightly interlaced dendrites are able to hold their shape and support considerable weight of liquid metals. Blind risers do not function effectively on gray iron castings because of their comparatively weak skin strength.

PAPERS ON STEEL CASTINGS

Cover Risers, Heat Treatment

AT the first of three technical sessions on steel castings discussions on knock-off risers and dimensioning of risers were presented under the direction of chairmen W. W. Moore, Burnside Steel Foundry Co., Chicago, and Howard F. Taylor, Massachusetts Institute of Technology. As explained by S. W. Brinson and J. A. Duma, both of the Norfolk Naval Shipyard, Portsmouth, Va., knock-off risers are differentiated from neck-down risers by the fact that they can be broken off with a 12-lb maul, hence are not over 2⅜-in. in diam. The authors found that the maximum depth of casting which can be fed with open knock-off risers appears to be 6, 8, 8, and 8 in. respectively for 2, 4, 6 and 8-in. diam billets using dry sand cores varying in thickness from ⅛ to ¾-in., respectively, for the 2-in. and 8-in. diam billets.

Second discussion, presented by J. B. Caine, Sawbrook Steel Castings Co., Lockland, O., dealt with "A Theoretical Approach to the Problem of Dimensioning Risers," and described the development of a hyperbolic equation to determine the riser dimension based on theoretical and experimental data. In its simplest form the equation becomes $x = 0.1/y - 0.03 + 1.0$ where x is the freezing ratio $A_c V_r / V_c A_r$ with A_c being the surface area of the casting; V_c the volume of the casting; V_r the volume of the riser, and A_r the surface area of the riser. The term y is the volume as determined by the equation: Volume of riser as poured/ Volume of casting.

For maximum riser efficiency and yield the riser should be proportioned so that the point representing the volume and freezing ratio falls just above and to the right of the curve between those areas representing shrinkage and solidity derived from the equations. In a masterly written discussion Harry A. Schwartz, National Malleable & Steel Castings Co., Cleveland, further developed Mr. Caine's data to calculate the most efficient feeder or riser if only a description of the casting is given without any dimensions.

An extremely interesting colored motion picture was shown at the roundtable luncheon of the Steel Division which followed the opening session. Prepared by W. H. Johnson and W. O. Baker, Naval Research Laboratory, Washington, it was titled "Gating Systems for Metal Castings," and depicted clearly that many of the common gating systems do not function as commonly supposed. For example, in conventional step gating feeding took place through the bottom branch with metal running into the upper steps as the metal reached them. With finger gates, major feeding was through the branches farthest from the sprue. Reversed horn gates did not decrease turbulence to any appreciable degree.

The second steel session provided three papers, two dealing with heat treatment and one with electrochemical cleaning. Frank Kiper, Ohio Steel Foundry Co., Springfield, O., presided, and V. E. Zang, Unitcast Corp., Toledo, O., was co-chairman.

"Tensile Properties vs. Composition of Double Normalized Cast Steel" was the title of a paper contributed by H. A. Schwartz, manager of research, and W. K. Bock, research engineer, research laboratory, National Malleable & Steel Castings Co., Cleveland, and presented by the latter. In this highly technical study, the authors derived an empirical equation for calculating tensile strength of double normalized acid electric and basic open-hearth cast steel from its chemical composition.

The second paper, titled "Delayed Quench for Steel Castings," and authored by S. L. Gertsman, physical metallurgist, division of mineral dressing and metallurgy, Bureau of Mines, Department of Mines and Resources, Ottawa, Canada, was read by J. E. Rehder of the bureau.

The process involves austenitizing at temperatures usually employed; a timed cooling from the austenitizing temperature to a temperature sufficiently above the Ar_3 to insure that in a plant operation no casting would be below the Ar_3 temperature; and a quench in water, followed by a draw to produce the required mechanical properties. Cracking susceptibility is lessened by quenching from the lower temperature. A considerable saving of furnace time is effected over the usual normalize-reheat-quench and draw procedure and with no sacrifice of mechanical properties.

Mr. Gertsman pointed out that since accurate controls are required and considerable preliminary work is involved, the delayed quench procedure is used best for light to medium castings produced in volume. Certain castings may not lend themselves to the delayed quench treatment.

Electrochemical Cleaning

Large castings of certain types for high-temperature, high pressure applications can be cleaned safely and economically by electrochemical methods, asserted J. A. Wettergreen, General Electric Co., Schenectady, N. Y., in the final paper at this session. He described the successful cleaning of an 18,300-pound casting by the method. The casting was the lower shell of a turbine, with a pouring weight of 43,300 lb. Its analysis was 0.20 carbon, 0.76 manganese, 0.37 silicon and 1.10 per cent molybdenum.

An abandoned molding pit was used to hold the 8 x 10 x 4-ft tank. The electrode supporting rod was 1½-in. diameter copper above the bath level and 2-in. steel below bath level with four ¼ x 4-in. bus bars. Approximately 19,000 lb of flake caustic soda were charged into the preheated tank and 11,000 lb were added at intervals during the first 24 hours. Melting temperature was approximately 300° C, with temperature later maintained at 400-450° C.

After preheating the casting to 400° C it was lowered into the bath. For electrical connections, one side of the bus was connected to the elec-

(*Continued on page* 128)

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(*Continued from page* 126)

trode support bracket and the other to the lifting device, the connection consisting of four ¼ x 4-inch copper bars for each side of the circuit.

For the oxidizing cycle, 2200 amperes was applied for 3 minutes and for the reducing cycle the polarity was reversed and cleaning was continued at 4000 amperes at 6 or 7 volts for about 2 hours. After observation of the results, the casting was cleaned again for 2½ hours. It was then allowed to drain and washed down with a hose. Checks for remaining caustic were made with litmus paper and phenolphthalein. Results of the experiment were extremely satisfactory, Mr. Wettergreen stated.

Final steel session was under the direction of J. F. Randall, Ford Motor Co., Detroit, and D. C. Zuege, Sivyer Steel Casting Co., Milwaukee. First paper, by H. H. Johnson and G. A. Fisher, National Malleable & Steel Castings Co., Sharon, Pa., was presented by Mr. Johnson and described "Statistical Quality Control; A New Tool for the Foundryman." Information was presented on principles underlying quality control, and how the methods were applied in the authors' foundry to indicate process control of various phases of producing castings.

Second paper, by J. D. Wozny and E. L. LeGrelius, American Steel Foundries, East Chicago, Ind., discussed "Techniques of Quality Welding of Plain Carbon Steel Castings" and was presented by Mr. Wozny. Investigation by the authors led to the following conclusions: Organic coated electrodes are not suitable for repair welding of plain carbon steel castings due to tendency to produce pinhole porosity. Lime or mineral coated electrodes generally produce welds free from pinhole porosity. Electrodes have been developed which will meet minimum physical properties of plain carbon steel. Tempering of welds in plain carbon steel has only a slight effect on the hardness of the weld metal or structure of the heat-affected zone. From the standpoint of hardness and microstructure, minor welds in plain carbon steel are just as critical or more critical than major welds. Plain carbon steel can be welded safely without any preheating up to the maximum section used in the study (2 in.).

EXPERIMENTAL WORK ON SAND

Described in Committee Papers

SIX papers were included in the two-session program arranged by the Sand Division. The opening session, at which surface gas pressures, chemistry of liquid steel, and sieve scales were discussed, was presided over by E. C. Troy, National Engineering Co., Philadelphia, and C. W. Briggs, Steel Founders' Society of America.

The first speaker was Harry W. Dietert, who, in collaboration with H. H. Fairfield and F. S. Brewster, all of Harry W. Dietert Co., Detroit, prepared a paper on "Surface Gas Pressure of Molding Sands and Core Sands." By immersing sand specimens enclosed in a tube in molten lead the authors determined the gas pressures generated, and found that as the moisture in the sand increased, the gas pressure at the mold face increased rapidly; that maximum gas pressure in dried sand is generated very slowly; that additions of seacoal cause a rapid rise in gas pressure, and increase in mold hardness delays time in which maximum gas pressure is developed. Other information gathered was that gas pressure at outer face of a core increases with increase of core oil and of cereal binder; that increased baked permeability reduces gas pressure, and that best results in reducing gas pressure obtain by holding fineness of sand, moisture and binders at the minimum.

J. B. Caine, Sawbrook Steel Castings Co., Lockland, O., and chairman of the Mold Surface Committee, AFA, presented a report on "Changes in Chemistry of Liquid Steel in Contact with Sand." Investigation by this newly formed committee led to the following conclusions: Oxidation and decarburization of the surface of steel in contact with sand is due to a reaction with the mold gases. Dissociated water vapor is the most active gas. Scaling during heat treatment will automatically remove the decarburized surface, unless excessive. Evidence from chemical analyses of penetrated metal discounts oxidation or volatilization as mechanisms of penetration of steel.

Concluding paper at the session was by R. E. Morey, Naval Research Laboratory, Washington, on "Sieve and Grade Scales" in which the author discussed briefly some 25 or 30 different types of sieve or screen sizing procedures, and scales for grading materials.

Under the chairmanship of J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind., and E. C. Zirzow, National Malleable & Steel Castings Co., Cleveland, three papers were presented at the second sand session. In presenting the first paper, P. E. Kyle, Cornell University, explained that it really was a progress report on high temperature properties of steel molding sands and to some extent was a continuation of a report submitted last year and published. Prof. D. C. Williams inaugurated the work at Cornell and carried on the experiments in the early stages. Since his removal to Ohio State University, the work has been in charge of Professor Kyle.

Suggests Seven Standard Sizes

The second paper, on the subject of strainer cores, was prepared and presented by H. L. Campbell, Western Foundry Co., Chicago. He proposes seven standard shapes and sizes of strainer cores for use in foundries. Size and number of holes in a strainer core determine the rate at which metal will pass through the core under a given head of metal. Selection of a strainer core should be based on the required delivery rate of metal to the mold cavity.

The speaker also stated that the AFA Core Test Committee intends to propose certain standard strainer core shapes and sizes. When definite designs are adopted generally the equipment needed to make the cores will be simplified. Pattern shops can provide prints of the established dimensions on all pattern equipment. In jobbing foundries where large numbers of different patterns are received, standard size strainer cores may be taken directly from stock without any delay in production. An illustration accompanying the paper showed the recommended size, shape and number of holes in seven models.

The third paper under the title "Causes of Rat Tail Casting Defect," and describing work carried out at the University of Michigan foundry by an AFA committee on physical properties of iron foundry molding materials at elevated temperatures, was presented by Harry W. Dietert, president, Harry W. Dietert Co., Detroit. The work was continued and completed at the Dietert research laboratory between Apr. 7 and Aug. 1, 1947.

Tentative conclusions based on available evidence indicate that this perennial thorn in the sides of foundrymen needs further investigation. Confined expansion test results correlate more closely with casting defects than do free expansion tests. There is some indication that confined expansion in excess of 0.040-in./in. is characteristic of the rat-tailing

(*Continued on page* 130)

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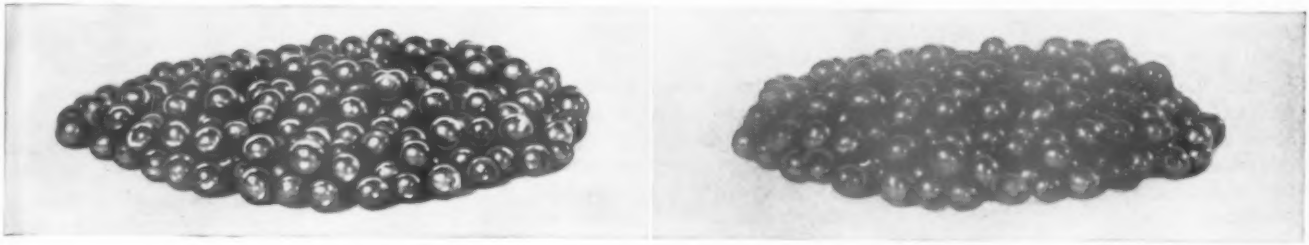

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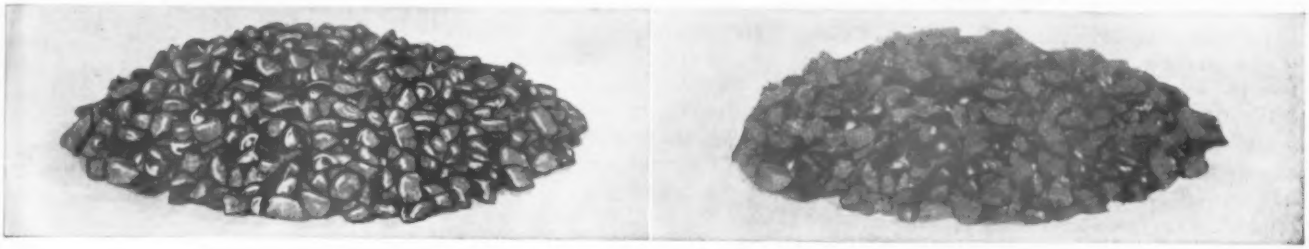

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(*Continued from page* 128)
sands examined. Confined hot shrinkage and free hot skrinkage seem to be related to the rat tail defect, at least to some extent.

The following theory is advanced to account for the results obtained on the hot shrinkage tests: There are three zones of hot shrinkage: 1. Sands which shrink less than 0.006-in./in. generally do not produce rat tails. 2. Sands which shrink 0.006 to 0.020-in./in. tend to produce rat tails. 3. Sands which soften and sag more than 0.020-in./in. generally do not produce rat tails.

GRAY IRON SHOP COURSE

Devoted to Cupola Operation

FOUR evening meetings sponsored by the Gray Iron Shop Course Committee were devoted to discussions of subjects pertaining to cupola operation. Good attendance attested to the popularity of these shop course sessions.

At the first session "Front Slagging of the Cupola" was discussed by T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va. Presiding was E. J. Burke, Hanna Furnace Co., Buffalo, assisted by Co-chairman A. N. Kraft, Wilkening Mfg. Co., Philadelphia.

Mr. Curry opened his remarks by saying that the front slagging spout cupola can be operated over a large range of air pressures and melting rates. This type of cupola is being operated at Lynchburg Foundry continuously for 24-hr periods and occasionally for 36 hr. The slagging spout on such cupolas should be at least twice as long as the breast, and the height of the dam should be one-fourth the windbox pressure plus ½ in. This formula can be adjusted according to operations until a satisfactory height is reached.

With reference to operation, Mr. Curry said that cupolas should be lighted 6 to 6½ hrs before wind time. When preparing the bed, 140 lb of limestone and 12 to 15 lb soda ash should be used to get a good volume of slag at the beginning of the heat. The iron should be made as hot as possible at the beginning of the heat.

Slag should start running 40 minutes after the wind is on. Black slag is an indication that the cupola is not running normally. Good slag, slow cooled will be olive-drab in color with a glassy fracture, and cooled in water it is spongy white and easily crumbled.

The question was asked as to whether front slagging cupolas were adapted to short time operations. One of the members of the audience stated that his company operates such a cupola for a period of 2½ to 3 hr daily. Further discussion also brought out that higher temperature irons are possible with front slagging cupolas, control of metal composition is easier and no slag wool is formed.

The second shop course was under the direction of H. H. Wilder, Eaton Mfg. Co., Vassar, Mich., and B. A. Miller, Baldwin Locomotive Works, Eddystone, Pa. Speaker was B. P. Mulcahy, Indianapolis, and his subject was "Effect of Blast Variation on Cupola Control." In opening his discussion Mr. Mulcahy stated that since air is one of the important items in melting in the cupola, attention should be paid to the proper engineering of the blast system, including control instruments. Piping, blower, tuyeres, lining, etc., should be maintained in good condition to obtain the best results.

According to the speaker, published tables on the quantity of air required per lb of coke are based on the maximum theoretical heat released—usually 136 cu ft per pound of coke. However, under such conditions the oxidizing conditions in the cupola would prevent production of iron suitable for castings. In general the figure of 100 cu ft per pound coke should be employed. Mr. Mulcahy said he believed that for cupolas up to 60 in. ID the tuyere area should be about 25 per cent of the cross-sectional area of the cupola, and above 60 in. diam the tuyere area can be from 15 to 25 per cent.

One reason for variation in cupola melting rate under present day conditions is the difference in surface area of large and small coke. Small coke requires a higher blast rate since more oxygen is necessary for combustion. Size of stock must be considered also. Small pieces of scrap iron and steel form a dense charge which is not penetrated by the combustion gases. On the other hand large material creates an open condition, and the length of time is too short for the material to pick up the heat, resulting in cold iron.

Third gray iron shop course had James A. Bowers, American Cast Iron Pipe Co., Birmingham, Ala., as speaker and W. W. Levi, Lynchburg Foundry Co., Radford, Va., and C. L. Lane, Florence Pipe & Machine Co., Florence, N. J., as chairmen. Subject of discussion was cupola coke, and Mr. Bowers said that there is no single test which will indicate the quality of a coke, but that good cokes rate highest in all tests. Coke size is important as carbon and sulphur decrease, silicon and manganese increase, and melting rate increases as coke size increases. He also stated there is an optimum coke size for each cupola operating under the same conditions.

In his own foundry it has been found that coke in the bottom drop functions as well as new coke for the bed, and now the practice is to flood the cupola drop with water to stop burning. Coke is picked out and used for the bed with additional new coke to bring it to the proper point. Best method of conserving coke is to have good cupola supervisors who understand melting rate, control instruments, etc. Method for determining proper bed height is to put in more than one thinks is needed and then reduce the amount gradually until best results are secured. Bed should be measured by distance below the charging door with an iron rod which should be checked from time to time as to length. Both coke and iron charges should be leveled off, and the scrap should not be in too large pieces.

Maintain Pouring Temperature

He mentioned that it is possible to ignite fine steel turnings with an oil torch, a reaction which possibly might be used to replace some of the coke. Placing light section castings close to the cupola and use of well preheated and insulated ladles help to maintain suitable pouring temperatures.

Concluding paper in the shop course series was presented by R. F. Flora, Clover Foundry, Muskegon, Mich. K. H. Priestly, Vassar Electroloy Products Inc., Vassar, Mich., presided, and Ralph Koch, U. S. Pipe & Foundry Co., Burlington, N. J., was co-chairman.

Mr. Flora's paper was entitled "Factors Affecting Fluidity of Cupola Iron." Fluidity was described as the ability of molten metal to flow and completely fill the mold cavity. The most important factor affecting fluidity is temperature, although metal composition also is important because it affects the solidification rate of the metal.

The effect of phosphorus is to reduce the solidification point of iron by extending the effect of silicon. An increase in carbon increases fluidity

(*Continued on page* 132)

Developing sound casting technics in pilot stage . . .

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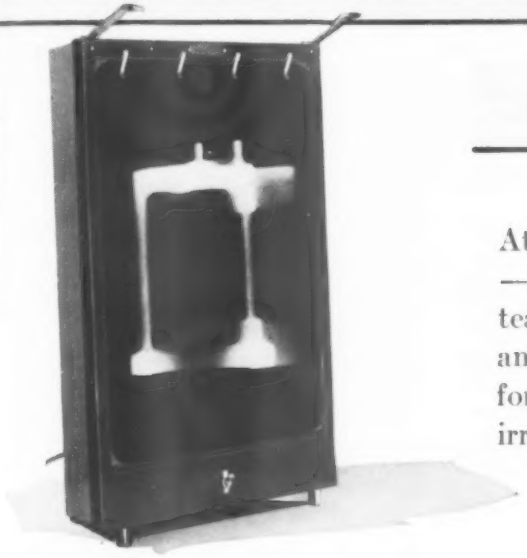

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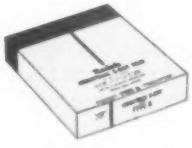

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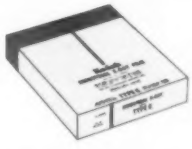

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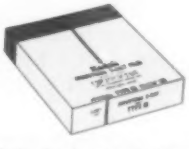

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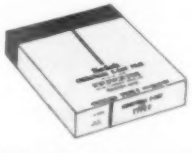

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(*Continued from page* 130)
up to the eutectic point. Increasing the moisture in the blast lowers the temperature and decreases the carbon and silicon content, causing a decrease in fluidity in irons below the eutectic. The opposite is true in irons above the eutectic.

During the discussion period, the ability to produce sound castings with high-phosphorus irons was questioned. It was pointed out that in the manufacture of sanitary ware, iron with a high-phosphorus content is used and the castings made from this iron are sound.

SAND PROBLEMS DISCUSSED

In Four Shop Course Sessions

PRACTICAL subjects relating to sand use in nonferrous, malleable iron, gray iron and steel foundries received extensive discussion at the four evening shop course sessions sponsored by the Sand Shop Course Committee. At the opening session J. J. Shannon, Jenkins Bros., Bridgeport, Conn., acted as discussion leader and outlined some of the problems involved in use of mechanical sand handling equipment in the nonferrous foundry. R. F. Thomson, International Nickel Co., Detroit, presided, and C. A. Sanders, American Colloid Co., Chicago, was co-chairman.

Mr. Shannon discussed clay balls which are built up in the cycle of mulling and conditioning. Most brass foundries still use natural sands of the Albany type, with AFA finenesses running from 140-180 and clay from 8 to 15 per cent. With this type of sand and with addition of either or both southern and western bentonite, for added green or hot strength, the clay balls not only pass through a No. 6 riddle but pile up against the pattern so they have poor flowability on sharp corners and pattern recesses. Being full of moisture they are frequently in the path of molten metal, which causes them to explode, ruining casting surface and causing porosity. To date no solution has appeared which is a remedy in all foundries.

The speaker also mentioned the small metal particles which infiltrate into sand, or small fins which break off from castings during the shakeout. Being nonmagnetic, both types are continually being built up in the sand and many of the so-called sand holes in finished castings after blast cleaning are nothing but unfused metal which falls out during cleaning.

Problem of hot sand and bridging of sand in the storage bin was mentioned. Instead of developing a tempered sand in the storage hopper, a continuous straight hole is burrowed through the center of the bin. The same sand is used over and over, which results in improper tempering, hot sand and resulting scrap losses. The clay-laden molding sand clings to the sides of the bin and it is necessary during shut-down time on weekends to have the bin cleaned out by shoveling and scraping the sides. Air guns, air blasts, vibrators have all been tried, but the storage bin still presents a major problem in handling heavily bonded sands.

R. P. Schauss, Illinois Clay Products Co., Chicago, led the discussion on malleable foundry sands at the second session, presided over by D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn., and F. S. Brewster, Harry W. Dietert Co., Detroit.

On the subject of core sand and core sand mixtures, the speaker claimed the best results followed the practice of adding any cereal or other dry binder to a dried sand. The mixture is mulled for a short time before adding water. Oil is the last ingredient to be added. Other points discussed included a reference to the comparatively new phenolitic resin core binder, the importance of selecting grain size for either core or molding sand, the effect of fines and silt, and the methods adopted to control the quality of the sand in use. In discussing seacoal use he directed attention to the fact that while in many instances seacoal additions to the sand improve the surface appearance of the castings, it reduces the permeability of the sand to an appreciable extent.

In subsequent discussion most of the interest centered on the number of sieves required to get a true perspective on the grain size most suitable for achieving certain advantages of sand for various purposes. Interesting comment based on experience during the conversion of his plant from a hand operated shop to a mechanically operated unit was contributed by the chairman, Mr. Sawtelle.

T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va., discussed "Gray Iron Foundry Sands" at the third session. E. L. Thomas, Cadillac Motor Car Co., Detroit, presided, with N. J. Dunbeck, Eastern Clay Products Co. Inc., Jackson, O., as co-chairman.

Mr. Curry's comments covered sand in a mechanized foundry as well as sand laid in windrows in front of molding machines. He maintained that calculations of moisture content, permeability, green strength and other characteristics contain about 15 per cent error, and he contrasted this with machinists' measurements which are accurate to thousandths of an inch.

This leaves plenty of room, in his opinion, for improvement in control methods. Foundries of all sizes need sand control procedures, and, regardless of foundry size, top management is responsible for setting up and maintaining such procedures. He added that although the engineering done by sand suppliers is good and has simplified the selection of materials from them, each foundryman must determine the best set of sand properties to do his particular job.

He pointed out that sand properties are interdependent; the changing of one property will alter the others. Furthermore, each time sand is worked or moved, it changes, thus mulling time is important. For synthetic sand he suggested a 50-second maximum mulling time after all ingredients have been added.

He pointed out that the use of a core sand which fits into the screen fineness desired for molding sand will help to simplify maintaining a sand of consistent properties.

Many Factors Involved

In conclusion he said that sand technicians, in addition to their knowledge of sand, must be familiar with all phases of foundry operations affecting sand. Among these he cited the importance of proper gating and risering, and an understanding of proper molding machine operations. Many times difficulties are blamed on sand when the real cause lies in the malfunctioning of machines or improper procedures in other operations.

During the lengthy discussion period Mr. Curry explained that proper sand flowability can be determined by limiting a mold operation to a fixed number of jolts on a molding machine; inspect the mold for fineness of detail, adjust the sand and then check the casting that has been poured in the mold. The sand will have to be adjusted until proper results are obtained.

D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn., presided at the concluding sand course session, devoted to steel foundry sands. Charles Locke, Armour Research Foundation, Chicago, acted as dis-

(*Concluded on page* 134)

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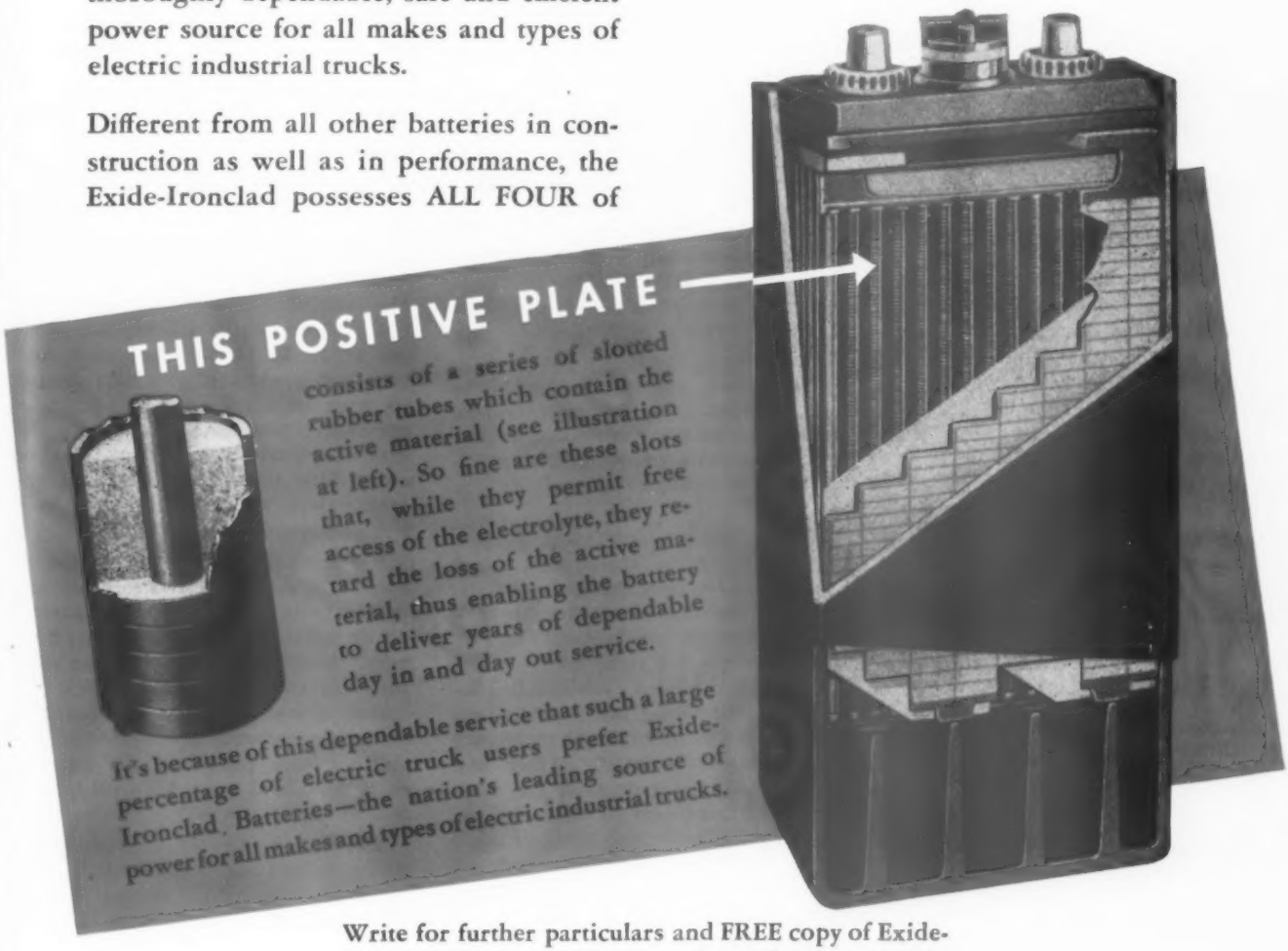
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(*Concluded from page* 132)

cussion leader.

Raising the question of what has been done in the foundry to take heat away from castings so that they may be handled with more facility, Mr. Locke stressed the importance of controlling density of molding sands and the effect of heat transfer on solidification of metals. Slides indicating the solidification of steel spheres, comparison of heat transfer measurements of various types of sands, and mechanism of solidification of metals were shown. Comparative slides showing temperature measurement of green sand close to mold and cement bonded sand indicated initial heat extraction at a faster rate with the cement-bonded sand than with the green. A coarse sand will subtract more heat than a fine sand, and chilling action of a mold will be greater as density of the molding material increases.

In the general discussion accelerators and retarders used to quicken and decelerate heat extraction came up for opinions. Mr. Locke stated the subject is timely because, more and more, silicates and other materials are being experimented with for this purpose.

Metal Congress in Philadelphia

The 30th annual National Metal Congress and Exposition, sponsored by the American Society for Metals, will be held in Philadelphia's Commercial Museum and Convention Halls for five days beginning Oct. 25.

Meeting simultaneously with the ASM will be the American Welding Society, the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers and the Society for Non-Destructive Testing (formerly the American Industrial Radium and X-ray Society.)

Book Review

Aluminum and Its Applications, by Hiram Brown and associates, cloth, 338 pages, 6 x 9 in., published by Pitman Publishing Corp., New York. Price $5.75.

The practical application of aluminum and its alloys is described in this book. The first eight chapters deal with the fundamental properties of aluminum alloys and their general usage, and with definitions of the metallurgical terms used in the text. The author has attempted to present the subject in a manner that is technical enough to give information clearly, but not too technical for the uninitiated to read and understand.

Complex formulas and diagrams have been avoided. Instead there are numerous illustrations and simple sketches demonstrating both fabrication methods and applications. Finishing, testing and heat treating are discussed, and aluminum alloys are classified with their distinctive properties and the most recent advances in fabrication stressed.

The next eight chapters were written by specialists in the fields of aircraft assemblies, aircraft engines, aircraft castings, automotive manufacture, railroads, marine assemblies, electrical appliances and equipment, and the chemical industries, to furnish authoritative discussion of specific applications.

The last chapter discusses the present and future of aluminum.

CUPOLA SPOUT TO BOX CAR IN 75 MINUTES

(*Continued from page* 73)

method is employed for moving the hot castings out of the way as they leave the shakeout. Instead of locating the casting conveyor at the working level—where it would interfere with floor space and the castings would create heat—the conveyor monorail rises sharply and leaves the main foundry building near the ceiling in its passage to the cleaning department. The casting conveyor line may be seen in the upper part of Fig. 10—in what otherwise would be waste space. The conveyor travels outside the building in moving to the cleaning department wing, giving the castings additional opportunity to cool.

In the cleaning department the line extends alongside three shot blast tables used to clean the brake drums, and the barrels which tumble the clutch housings. As indicated in Fig. 16, the drums are removed from the conveyor and placed over spindles located on individual tables which revolve at the same time the machine's main table is rotated. After one revolution of the main table the castings are turned over to clean the opposite sides and then are returned to the conveyor. Exhaust equipment removing air at the rate of 18,000 cfm is connected to the blast tables.

The 12 tumbling mills, each 36 in. diameter and 6 ft long, shown in background in Fig. 15, are equipped with a 20,000-cfm exhaust system with an automatic cutoff which operates when the units are stopped for loading or unloading.

From the cleaning equipment the castings are conveyed past inspection stations where each piece is inspected, chipped and ground and returned to the conveyor (Fig. 15), which then proceeds to the adjoining shipping dock. There the castings are finally removed and stacked in freight cars for shipment (Fig. 2).

Record is kept by the inspection department of any defective castings received, and reports are issued hourly to molding foremen, indicating the type of defect. A marking system permits tracing a defective casting back to the machine on which the mold was made, thereby permitting prompt correction of any molding fault responsible for the trouble. Castings also are checked at regular intervals to see that they fall within dimensional allowances.

Reduce Sand Temperature

Sand from the shakeouts drops through the screens to underground belt conveyors, and comes above floor level on the belt shown in Fig. 10, to be deposited first in a cooler screen. This revolving screen, a close-up view of which is shown in Fig. 11, is 8 ft in diameter and 28 ft long and reduces the sand temperature and removes foreign material before the sand is transferred by elevator to one of the three 70-ton capacity storage bins above the mixers. Each of the three mixers, shown in Fig. 12, handles 2500-lb batches and provides total capacity of 115 tons of mixed molding sand per hour. Sand used is a Tennessee product of 12 to 14 per cent clay content, and permeability is held around 60 with moisture content of 5.6-5.8 per cent. New sand is added to the system, which contains a total of about 1400 tons, at the rate of approximately 1 lb new sand for each 8 lb of poured casting.

From the mixers sand is carried by bucket type elevator to overhead conveying belts from which it is plowed off at individual molding station hoppers. Routine tests of the sand mixture are made each 15 minutes.

Only a small coreroom is operated, since requirements are limited to the strainer core placed in the gate of each mold, and cores for chill test of iron at cupola.

The melting department comprises four cupolas lined to 68 in. ID. These furnaces are located at one side of the main foundry building so that charging is carried on from the outside (Fig. 3) and tapping is accomplished inside (Fig. 1). Raw materials from the stock yard are loaded in a charging bucket carried by the car shown at the right in Fig. 3. This electrically-driven car travels on

(*Concluded on page* 136)

KNIGHT Services for Foundries...
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- Foundry Management—Several Knight engineers, with many years of management experience in various types and sizes of foundries, are particularly qualified to take over temporary management of your foundry or to work with you in ironing out management problems.
- Industrial Engineering; Job Evaluation, Incentives—General foundry practices must be as modern as the facilities. An efficiency survey of your plant by men of the Knight organization will result in specific recommendations for betterment of labor-management relations, establishment of fair wage incentives, standards and cost control which will pay management big dividends in increased production and profit.

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(*Concluded from page* 134)

tracks under hoppers to collect the required amount of coke, scrap and pig iron and then is driven to the cupolas where the bucket is picked up by a crane and hoisted 35 ft to the charging door for dumping. Fig. 3 shows one bucket being lifted, while a second bucket is ready with another charge. This illustration also shows the rear slagging trough which leads the slag to a water bath from which it is removed by a bucket conveyor.

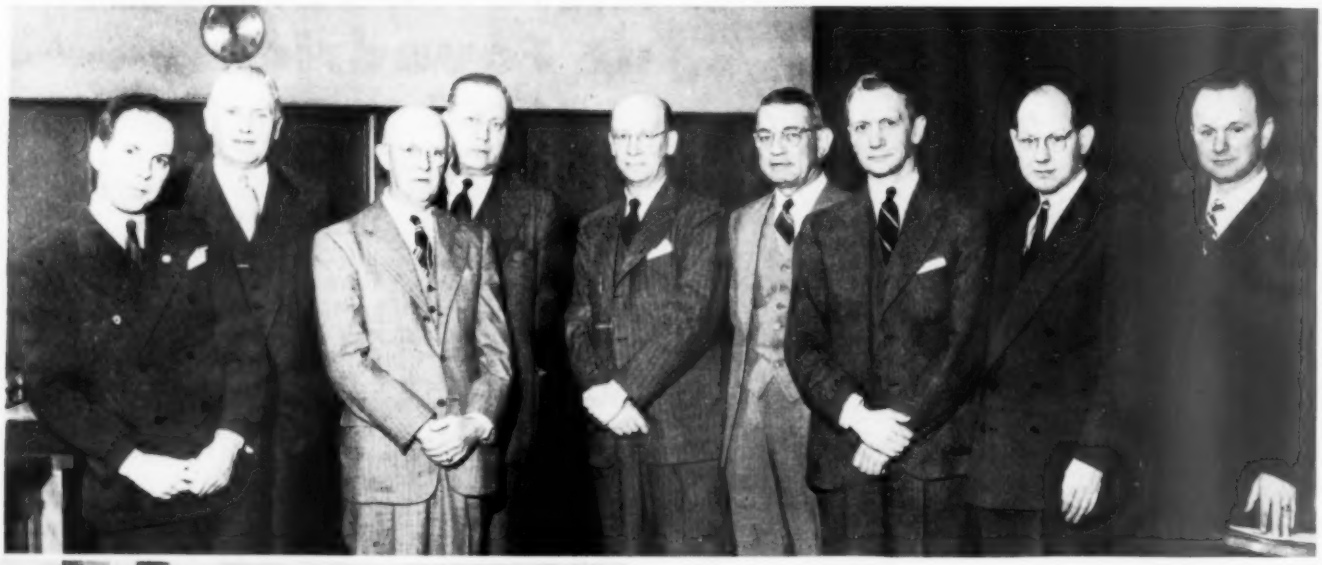
Usually only one cupola is operated at a time and tapping is continuous, the iron pouring into a reservoir which is tilted to fill the tapping ladles as required. The cupolas are elevated above the foundry floor level on a mezzanine, so that only the filling of ladles and transportation of the molten iron occupies space within the foundry floor area.

Close control is exercised over melting operations. In addition to the checking of raw material composition, chill tests are made of the iron every ladle, and metal composition is analyzed hourly for silicon, carbon, sulphur and manganese. Carbon is held around 3.30-3.45 per cent, with silicon ranging from 2.10 to 2.40 per cent depending upon type of casting being poured. Brinell hardness ranges from 160 to 200, and minimum tensile strength is 35,000 psi. Alloy composition iron is employed for heavy duty type drums.

Control of dust at the shakeouts, hooding of the mold conveyor lines and prompt removal of hot castings from the floor level all combine to make this foundry unusually clean. Total capacity of exhaust equipment, including the cleaning department units as well as localized and general units in the main foundry building, is in excess of 400,000 cfm. All exhausts in connection with the sand system feed into two roof-mounted wet collectors shown in Fig. 13.

Design, fabrication and erection of the foundry installation was handled by the C. O. Bartlett & Snow Co., Cleveland, and the illustrations of Figs. 9, 11, 12 and 13 are by courtesy of that company.

Foundry Education Discussed at Northwestern Meeting



Scenes at Northwestern Technological Institute, Evanston, Ill., Apr. 8, when the school was host to the Foundry Educational Foundation and high school instructors and students in the midwestern area are shown here.

School and foundation officials shown above are, left to right: Bruce L. Simpson, National Engineering Co., Chicago; Dean Ovid W. Eshbach of Northwestern; W. G. Mixer, Buick Motor Division, Flint, Mich., speaker at the meeting; Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, O.; Stowell C. Wasson, National Malleable & Steel Castings Co., Chicago; R. J. Redmond, Buckeye Foundry Co., Cincinnati; Anthony Haswell, Dayton Malleable Iron Co., Dayton, O.; Prof. B. H. Jennings of Northwestern; George K. Dreher, Foundry Educational Foundation, Cleveland.

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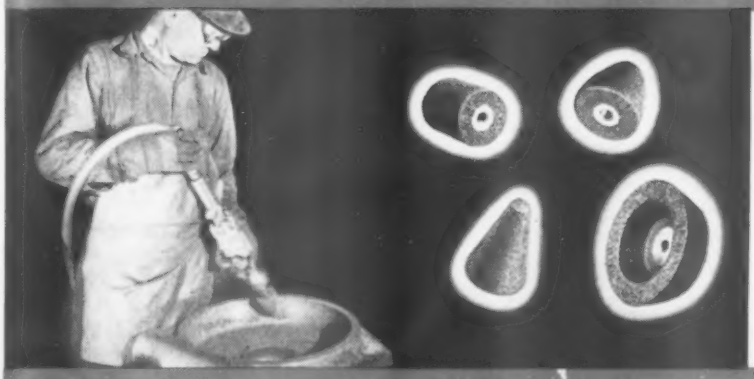

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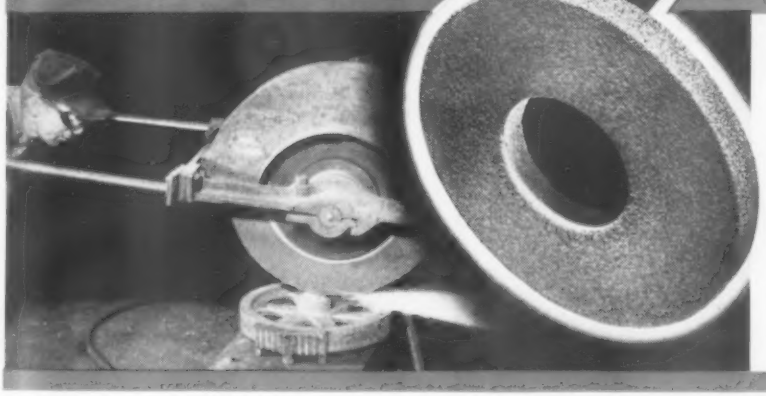

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INDUSTRY *Briefs*

COMMONWEALTH Plant of General Steel Castings Corp., Granite City, Ill., almost doubled the world's previous safety record for steel foundries with 1,738,518 man-hours without a lost-time accident between Jan. 2 and Apr. 20. Previous record was established by the Eddystone, Pa., plant of General Steel Castings in 1943 when that plant went 960,139 man-hours without a lost-time accident.

* * *

Cocker Machine & Foundry Co., 207 South Chestnut St., Gastonia, N. C., has begun clearing ground for a new foundry to be located on the Lowell-Gastonia road several blocks from the main plant. New plant will be 80 x 100 ft with aluminum facing. The firm recently completed a $25,000 brick building to house the drafting, tool and exhibition rooms and laboratory.

* * *

Chicago Eye Shield Co., 2300 Warren Blvd., Chicago 12, has appointed Guardian Safety Equipment Co., 4606 Walnut St., Philadelphia, distributor in Delaware, Maryland, eastern Philadelphia and lower New Jersey. Guardian company is headed by Fred R. LaForce, who previously was a sales and safety engineer for Chicago Eye Shield Co.

* * *

Morrison Engineering Corp., Cleveland, has been awarded contract in excess of $100,000 from the Air Materiel Command of the U. S. Army Air Forces, for 65 electric heat treating furnaces. These heat treating furnaces have a temperature range of 250-1850°, with automatic closing temperature control.

* * *

Catron Casting Co. has moved into a new office and factory at 2000 Davie Blvd., Fort Lauderdale, Fla. Corporate offices, however, remain in Detroit at 843 Penobscot Bldg. All orders, inquiries and other correspondence should be addressed to the Fort Lauderdale address.

* * *

Lawran Foundry Co., 1928 South 62nd St., Milwaukee, plans to move into its new building at 4700 West McGeoch Ave., during July. The old building has been sold to the Plating Engineering Co. In the new location Lawran Foundry will be in a position to mechanize a large portion of its brass, aluminum and bronze casting operations, and foundry capacity is expected to be increased substantially.

* * *

Bloom Engineering Co. Inc., Pittsburgh, manufacturer of industrial and steel mill furnace burners, has purchased Paulsen Engineering Co., Cleveland, and will continue that company's production of blast furnace gas burners for stoves and boilers.

* * *

S. U. S. Die Casting Co., Logansport, Ind., is adding two new die casting machines, bringing its total to six aluminum casting machines and increasing its output by 50 per cent. The firm has been located in Logansport approximately two years, having operated previously in Detroit.

* * *

Donovan Inc., will move its foundry located at 1725 Carroll Ave., Winona, Minn., to its plant at 1080 North Hazel St., St. Paul. The move is being made to take advantage of the economies of operating one plant instead of two.

* * *

Crown City Die Casting Co. has obtained a permit for construction of a new shop building at 84 North Fulton St., East Pasadena, Calif. The $10,000 structure will cover about 4800 sq ft of floor space.

* * *

Following a recent fire at the plant of the Majestic Co., Huntington, Ind., offices have been moved to the former Farnsworth Radio & Television Corp. offices on South Lucretia St., Huntington, for an indefinite period.

* * *

H. M. Foundry Co., Plymouth, Ind., has discontinued business and the foundry building has been sold to the Indiana National Guard for use as a drill and meeting headquarters.

* * *

Metal Coating & Mfg. Co., 129 West Main St., Elwood, Ind., has installed a zinc die casting machine for production of hardware for caskets and other ornamental pieces.

* * *

Material Movement Industries Inc., has moved its general offices to its plant at 9257 Laramie Ave., Skokie, Ill.

* * *

United Aluminum Castings Co. Inc., has moved its plant to 100 Mill St., Berea, O., from 3471 West 140th St., Cleveland.

ON BLOCK: Symington-Gould Corp.'s $5 million plant at Rochester, N. Y., is being sold through the Asset Realization Co. of Newark, N. J., and New York. The company is closing out operations in Rochester after being engaged in the foundry and machine shop business there for more than 30 years. Future operations will be centered at the company's Depew, N. Y., factory. The Rochester property includes more than 40 acres of land, improved with buildings having an aggregate of 475,000 sq ft, including the main structure of over 300,000 sq ft under one roof

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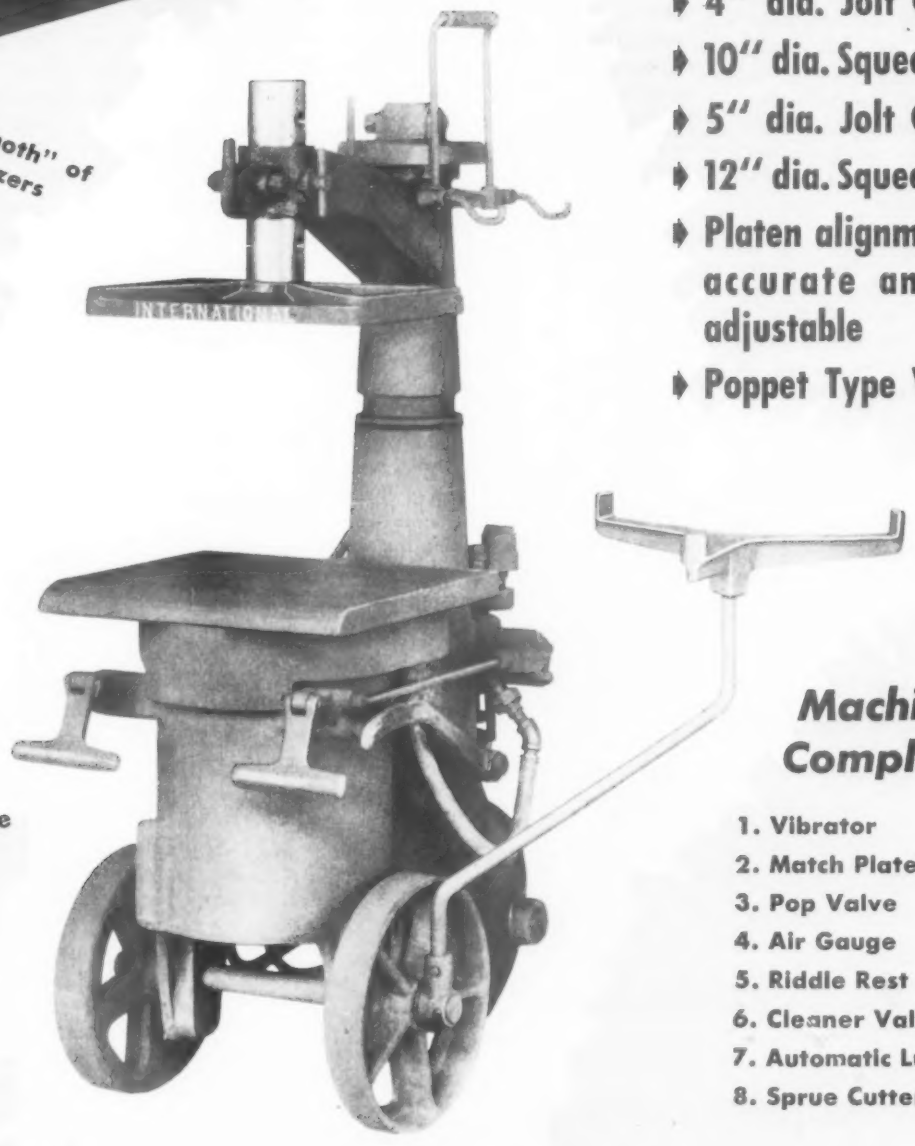

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ALUMINUM ALLOY CASTINGS

(*Continued from page* 95)

lighter sections.

Proper coating of the mold thus is an important element in the permanent mold art. The coating material itself can be almost any refractory made up as a water suspension of finely ground powder with a suitable binding agent.

Wherever possible, a mold is designed so that when it is opened to remove the casting the mold surfaces leave the casting surfaces at angles between 45 and 90 degrees, in order to avoid undue abrasion of the coating. Where such design is not feasible, it is important that surfaces subject to excessive abrasion be readily accessible for frequent renewal of the coating.

It is extremely difficult to set down any specific rules for either mold construction or coating. The mold cavity, of course, must conform to the casting design, and the arrangement of sprue, runners, gates and risers must meet the requirements for the production of sound castings. Cores must be readily inserted and removed, and multipiece cores should be constructed of the fewest pieces possible for the required results. Beyond these relatively general requirements, the ingenuity and experience of the mold designer must be relied upon to produce the best mold design for any given casting. As mentioned previously, he often can suggest changes in the design of the casting that will permit a simpler and better mold design.

Sand cores for semipermanent-mold casting are similar to those used for sand casting, as covered in a previous article of this series. Dry binders are used for green strength in conjunction with oil binders to maintain the required core strength in the hot mold before the casting is poured.

Mechanized Production—As in sand foundries, a high degree of mechanization has been developed in permanent mold operations. This mechanization was accelerated by the unprecedented demands made on the aluminum casting industry during World War II, extending to most of the large and medium-size plants and also to many of the smaller units. Because of the inherent differences between sand and permanent mold casting, however, the production setups are considerably different.

Absence of the entire sand handling and conditioning equipment in permanent-mold casting means that much less foundry space is required for the same production than with sand casting. In addition, much less space is occupied by the metal mold and its accessories than by the equivalent flasks, molding machine, and accessories in a sand casting setup.

In sand casting, either the metal may be carried to the mold for pouring, or the mold may be taken to the furnace. In permanent mold casting, both the mold and the metal may be stationery. This means that each mold or group of molds must have its own reservoir of molten metal, which is usually either a holding furnace of the pot or crucible type or a combined melting-holding furnace.

Mechanical conveyors are used extensively for handling both raw materials and the product. In a typical large foundry, for example, the molten metal is conveyed from a centrally located melting furnace via an overhead monorail trolley conveyor to holding furnaces at each pouring station. A continuous low-speed overhead trolley-type conveyor extending around the entire production area carries the castings away from the pouring stations and into the trimming and finishing room. The castings are simply hooked onto the conveyor after they are removed from the molds, cooling en route.

The permanent mold method is inherently a continuous process, and all operations entering into the permanent mold production of aluminum castings must be kept closely in balance for maximum high-quality production.

Method Has Wide Application

Castings of a wide variety of types can be cast successfully by this method and the use of sand cores in the semipermanent-mold process makes possible the successful casting of pieces too intricate to handle from a practical standpoint by the full permanent mold method. The variety of castings that can be produced successfully in metal molds is limited mostly by the experience and ingenuity of the mold designer.

Metal-handling methods in a permanent-mold foundry must be geared to the inherent continuous nature of the process, and accurate temperature control is particularly important with proper mold temperature being added to the temperature requirements of the sand casting process.

Previous articles in this series have discussed the aluminum alloys commercially available, and sand molding and handling procedures. Subsequent articles will cover casting, trimming, machining, and surface-finishing procedures, heat treatment, inspection and quality-control methods.

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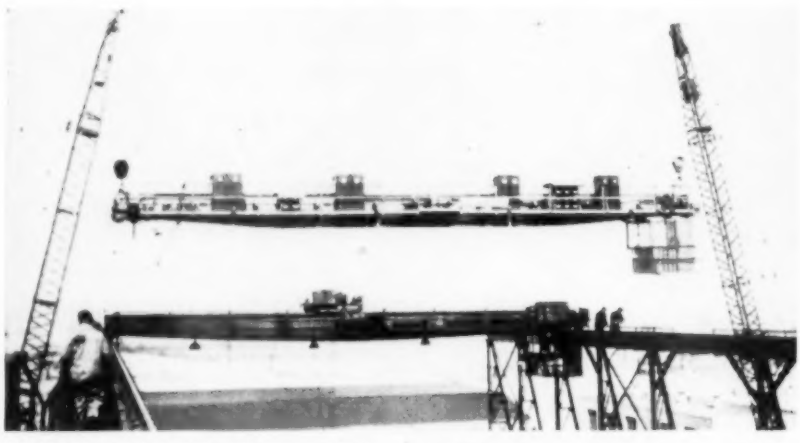
2. *Casting Alcoa Alloys*, Aluminum Co. of America, 1947.

3. Reference Data Bulletin 45 PMC, the Permold Co., 1945.



CRANES PLAY LEAPFROG: Lifting a twenty-ton crane is quite a chore in itself, but when it is hoisted over another crane resting on a track 43 ft above the ground, it becomes an engineering feat. At the plant of Eaton Mfg. Co., Foundry Division, Vassar, Mich., two such mammoth cranes were switched to opposite ends of the track in six minutes of actual moving time. A pair of 80-ft beam mobile hoists lifted one of the cranes 17 ft above the track, while the other was moved under it. The addition of a second crane is part of an extensive program to improve Eaton's facilities for making permanent mold gray iron castings

E. A. Vermere Inc., 1821 Randolph St., Los Angeles, die casting plant, suffered $250,000 fire loss Mar. 20.

THE FOUNDRY DATA SHEET JULY, 1948

TENTATIVE SPECIFICATIONS FOR ALUMINUM-BASE ALLOY SAND CASTINGS

ASTM Designation: B 26-47 T;

Issued 1933; Revised, 1936, 1937, 1941, 1942, 1943, 1944, 1946, 1947,

(Concluded from June issue)

Retests

10. If the results of the tension tests do not conform to the requirements prescribed in Table II, the castings may be reheat-treated but not more than twice. The results of acceptable tests shall conform to the requirements as to tensile properties specified in Table II.

Workmanship and Finish

11. The finished castings shall be uniform in composition and as free from blowholes, cracks, shrinks, and other injurious defects as the best commercial practice will permit.

Inspection

12. (a) Inspection may be made at the manufacturer's works where the castings are made, or at the point at which they are received, at the option of the purchaser.

(b) The general requirements specified in Section 11 shall be checked by visual inspection of the castings or by comparison with observational standards where such standards are established. It is advisable that observational standards representing acceptable material be established which will govern when any question arises as to what defects are permissible under the best commercial practice.

(c) If the purchaser elects to have inspection made at the manufacturer's works, the manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works.

Rejection

13. Castings that show injurious defects revealed by machining operations subsequent to acceptance may be rejected, and if rejected shall be replaced by the manufacturer without charge to the purchaser. The full weight of the original material rejected shall be returned to the manufacturer.

Rehearing

14. In the case of dissatisfaction regarding rejections based on chemical composition and tensile property requirements specified in Sections 3 and 6, respectively, the manufacturer may make claim for a rehearing as the basis of arbitration within a reasonable time after receipt by the manufacturer of the rejection notification.

Explanatory Notes

Note 1: *Alloy C1.*—Alloy C1 has a specific gravity of about 2.77. It is used for general casting purposes where a combination of lightness, high strength and ductility is desired. The various strengths are obtained through different heat treatments. Heat treatment No. 1 gives maximum elongation and resistance to shock. It is a solution heat treatment and may be specified where the most rugged service is required. On standing at room temperatures, the alloy age hardens over a period of a few months to develop mechanical properties approaching those of heat treatment No. 2. Heat treatment No. 2 is a solution and precipitation heat treatment, and should be specified where a higher initial strength, yield strength, and hardness are desired. Heat treatment No. 3 should be specified when the highest strength and hardness are desired and lower ductility is not objectionable. Heat treatment No. 4 is a solution treatment followed by an "over aging" precipitation treatment to relieve residual stresses and minimize permanent dimensional changes in castings that are subject to heating in service. This alloy with the various heat treatments is used in general for high strength parts in street cars and busses, parts for internal combustion engines, outboard motor parts and other marine castings.

Alloy G1.—Alloy G1 has the highest resistance to corrosion of any of the commercial aluminum casting alloys. It is not so easily cast as some of the other alloys, which fact should be considered when designing complicated castings. Its specific gravity is about 2.63.

Alloy G3.—The specific gravity of alloy G3 is about 2.58. The alloy is used only in the heat-treated condition and is not recommended for use at temperatures above about 200 F. It combines the highest strength and elongation of any commercial aluminum alloy sand casting with good resistance to shock and corrosion. It is used chiefly for structural parts.

Alloy S1.—The specific gravity of alloy S1 is about 2.66. This alloy is similar to alloy S2 except that it is held to closer chemical composition limits which results in greater corrosion resistance.

Alloy S2.—Alloy S2 is somewhat lighter than aluminum, having a specific gravity of about 2.66. It withstands corrosion better than the copper alloys. The free flowing property of the alloy when molten makes it easier to pour castings of thin section or intricate design. Its leak proof properties are valuable where pressure tightness is essential. It has a lower tensile and yield strength than the copper-aluminum alloys and poorer machining qualities. It is especially suitable for automobile body parts, cooking utensils, architectural, and marine castings.

Alloy CG1.—The specific gravity of alloy CG1 is about 2.85 and the pattern shrinkage about 0.156 ($\frac{5}{32}$) in. per ft. This alloy is used for pistons, cylinder heads, valve guides, and bearings or other parts where hardness and good bearing qualities are essential. Together with alloy CN21 it posseses the property of retaining at higher temperatures a greater percentage of its room temperature strength than any other alloy in this group. This alloy may be heat treated, in which case substantially higher strength and hardness or other desirable characteristics are obtained.

Alloy CN21.—The specific gravity of alloy CN21 is about 2.73. It is usually employed in the heat-treated condition. The alloy is used for pistons, cylinder heads, valve guides and bearings or other parts where hardness or good bearing qualities are essential. Together with alloy CG1 it possesses the property of retaining at higher temperatures a greater percentage of its room-temperature strength than any other alloy in this group.

Alloy CS5. Alloy CS5 has a specific gravity of about 2.79. It is a good general purpose alloy which combines fair strength, good machinability and good casting characteristics with a fair resistance to corrosion.

Alloy CS22.—The specific gravity of alloy CS22 is about 2.83 to 2.86. The pattern shrinkage is about 0.156 ($\frac{5}{32}$) in. per ft. It supersedes the 8 per cent copper alloy without silicon, as it possesses better casting characteristics, especially in the more difficult work. It has excellent machining qualities. This alloy is used for general casting purposes.

Alloy GS1.—The specific gravity of alloy GS1 is about 2.65. The alloy has a high resistance to corrosion and tarnishing and somewhat better casting characteristics than alloy G1. It is commonly used for architectural castings and cooking utensils.

TENTATIVE SPECIFICATIONS FOR ALUMINUM-BASE ALLOY SAND CASTINGS

ASTM Designation: B 26-47 T;

Issued 1933; Revised, 1936, 1937, 1941, 1942, 1943, 1944, 1946, 1947.

Alloy SC8.—The specific gravity of alloy SC8 is about 2.77. It is a general purpose alloy combining good strength, machinability and casting characteristics with a fair resistance to corrosion under most conditions of exposure.

Alloy SC21.—Alloy SC21 has a specific gravity of about 2.68. It has good casting qualities. It is used extensively for liquid cooled cylinder heads and other castings which are subjected to elevated temperatures in service. Heat treatment No. 1, consisting of a solution and precipitation treatment, provides optimum combination of strength and ductility for this alloy. Heat treatment No. 2 is a precipitation treatment only and serves to stabilize dimensions in parts subject to heating in service. Heat treatment No. 3 is a solution treatment followed by an "over aging" precipitation treatment to relieve residual stresses and minimize permanent dimensional changes in castings subject to heating in service.

TABLE III
TYPICAL YIELD STRENGTHS

Alloy	Condition	Typical Yield Strength (0.2 per cent offset), psi.
C1	Solution heat treated (Heat treatment No. 1)	16 000
	Solution treated and aged (Heat treatment No. 2)	22 000
	Solution treated and aged (Heat treatment No. 3)	31 000
	Solution treated and over-aged (Heat treatment No. 4)	19 000
G1	As cast	12 000
G3	Solution heat treated	25 000
S1	As cast	9 000
S2	As cast	9 000
CG1	Annealed (Heat treatment No. 1)	20 000
	Solution treated and aged (Heat treatment No. 2)	30 000
CN21	Annealed (Heat treatment No. 1)	20 000
	Solution treated and aged (Heat treatment No. 2)	32 000
CS5	As cast	14 000
CS22	As cast	14 000
GS1	As cast	13 000
SC8	As cast (Heat treatment No. 1)	12 000*
	Solution treated and aged (Heat treatment No. 2)	18 000*
SC21	Solution treated and aged (Heat treatment No. 1)	25 000
	Aged (Heat treatment No. 2)	23 000
	Solution treated and over-aged (Heat treatment No. 3)	29 000
SC42	As cast (Heat treatment No. 1)	.....
	Solution treated and aged (Heat treatment No. 2)	.....
SG1	Solution treated and aged (Heat treatment No. 1)	22 000
ZG41	Aged (Heat treatment No. 2)	20 000
	Aged	25 000

* If the magnesium content exceeds 0.15 per cent, substantially higher yield strengths may be expected.

Alloy SC42.—The specific gravity of alloy SC42 is about 2.68. It has excellent casting characteristics and a good resistance to corrosion and has been used extensively for internal combustion engine parts.

Alloy SG1.—The specific gravity of alloy SG1 is about 2.65. It has casting qualities and resistance to corrosion comparable with those of alloy S1 (see Note on alloy S1). Its higher mechanical properties result from heat treatment processes. Heat treatment No. 1 is a solution and precipitation heat treatment providing the optimum combination of tensile strength and elongation. Heat treatment No. 2 is a precipitation treatment only and serves to stabilize dimensions in parts subject to heating in service.

Alloy ZG41.—This alloy has a specific gravity of about 2.80. It is a general-purpose alloy having high physical properties which are obtained by either room temperature aging of several weeks duration or by artificial aging. Solution heat treatment is not required. Within the first two weeks after casting, the alloy has high ductility, permitting severe cold deformation.

NOTE 2.—The yield strength of aluminum-base alloys is defined as the stress at which the stress-strain curve deviates 0.2 per cent from the modulus line. It may be determined by the "Offset Method" or the "Extension Under Load Method" (the latter is often referred to as the "Approximate Method Without the Stress-Strain Diagram") as described in the Standard Methods of Tension Testing of Metallic Materials (A.S.T.M. Designation: E8) of the American Society for Testing Materials.[3] Table III gives typical yield strength values for the sand-cast aluminum alloys.

APPENDIX

The data in the following table are approximate and are supplied for general information only:

TABLE OF SUPPLEMENTARY DATA

Alloy	Former Alloy Designation	Approximate Specific Gravity	Corrosion Resistance	Casting Properties	Response to Heat-Treatment	Principal Uses	Machinability
C1	G	2.81	Good	Good	Yes	General, where high strength and ductility are required	Very good
G1	L	2.65	Excellent	Fair	No	Cooking utensils, food handling equipment, marine fittings, and other castings requiring maximum resistance to corrosion	Very good
G3	..	2.58	Excellent	Fair	Yes	High strength structural castings	Very good
S1	JJ	2.69	Very good	Excellent	No	Cooking utensils, marine fittings, food handling equipment, and ornamental parts requiring good resistance to corrosion	Fair
S2	J	2.69	Good	Excellent	No	General castings requiring pressure tightness	Fair
CG1	F	2.95	Fair	Good	Yes	Air-cooled cylinder heads, pistons, and castings requiring good strength and hardness at elevated temperatures	Excellent
CN21	H	2.81	Good	Fair	Yes	Air-cooled cylinder heads, pistons, and castings requiring strength and hardness at elevated temperatures	Very good
CS5	..	2.79	Fair	Good	No	General purpose	Good
CS22	C	2.91	Fair	Very good	No	Automotive crankcases, oil pans, transmission cases, miscellaneous general-purpose castings	Excellent
GS1	..	2.65	Excellent	Fair	No	Cooking utensils and pipe fittings	Excellent
SC8	..	2.77	Fair	Good	Yes	General purpose castings	Good
SC21	N	2.70	Good	Excellent	Yes	Aircraft engine crankcases, oil pans, liquid cooled cylinder heads, and other intricate high strength castings	Good
SC42	..	2.69	Good	Excellent	Yes	Aircraft engine crankcases, oil pans, liquid cooled cylinder heads, and other intricate high strength castings	Good
SG1	M	2.68	Very good	Excellent	Yes	General, where high strength and corrosion resistance are required.	Good
ZG41	O	2.80	Good	Good	*	General, where high strength and ductility are required	Excellent

* See Explanatory Note 1.

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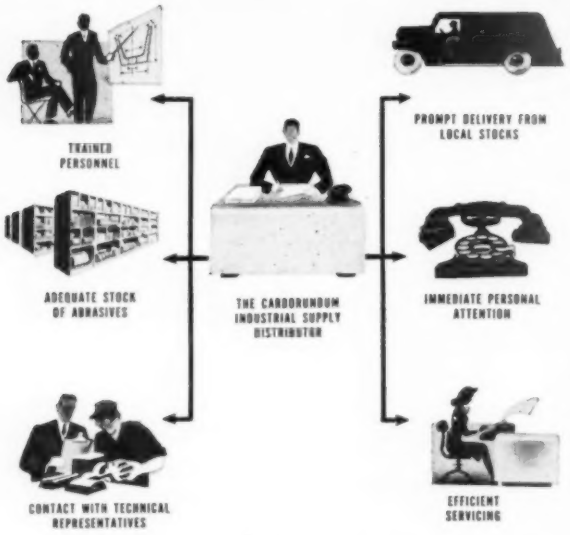

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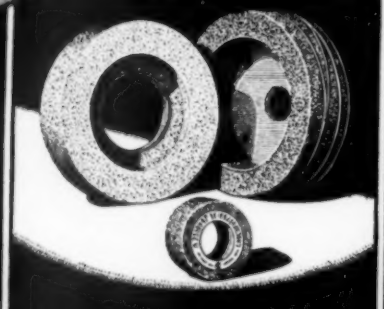

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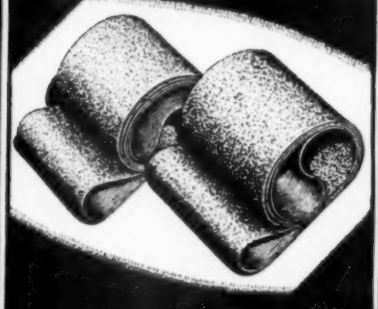

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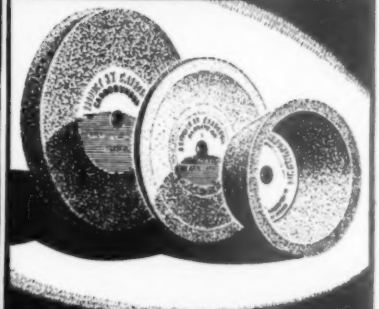

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READERS' COMMENT • • •

Wrong Winner Was Listed

TO THE EDITORS:

On page 124 of the June issue of THE FOUNDRY reference is made to AFA apprentice contest winners as announced at the convention. Third place award in the patternmaking contest was won by Robert J. Schneider, apprentice, employed by Midwest Pattern Co., 1230 N.E. Quincy, Minneapolis, Minn. Mr. Schneider is a graduate of our St. Paul Vocational School pattern shop and is a resident of the city of St. Paul. He received a check and a certificate signed at AFA national headquarters.

It is quite evident that somewhere an error has been made. We are justly proud of Mr. Schneider and his accomplishments and, therefore, take this means of calling your attention to the statements made in the current issue and comparing them with the facts.

H. W. TEICHROEW
Trade and Industrial
Education Co-ordinator
St. Paul Vocational School
St. Paul

Editor's Note: An error was made by the AFA in transcribing from the judges' score sheets, resulting in an incorrect announcement originally of apprentice winners. **See page 209.**

° ° °

Two-year Training Inadequate

TO THE EDITORS:

I read Mr. Holmes' article on training apprentices in the May issue of THE FOUNDRY, and frankly it burned me up. He evidently does not know Mr. Cech or what he has done in Cleveland in training pattern apprentices. Mr. Holmes may know something about patternmaking and molding, but I doubt very seriously his statement that he can train wood or metal patternmakers in two years. The only reaction to a statement like that is that in Mr. Holmes' business he only requires a two-year apprentice to do his class of work, or he doesn't know what he is talking about.

I would be interested in receiving a copy of his apprentice program, if he has one. He says that he is able to do something that every good practical patternmaker knows can't be done.

I felt as though I was doing a job here with a fair amount of success, and along comes a "guy" with a statement that knocks all my effort into a "cocked hat." He may have something that my thirty years as a patternmaker and my ten years as a patternmaking teacher has missed; if he has, wise me up.

ELWOOD B. STEINER

Springfield High School
Vocational Department
Springfield, O.

* * *

Says Costs Are Comparable

TO THE EDITORS:

Referring to the article in the March, 1948, issue of THE FOUNDRY entitled "Aluminum Alloy Castings" by Floyd A. Lewis, I believe the author is in error in his statement that clay graphite crucibles are considerably more expensive than iron pots.

As a matter of fact, the f.o.b. cost of iron pots and graphite crucibles is about the same for the same capacities, and we allow the freight at least in the eastern United States.

When the number of heats or life of the clay graphite crucibles is taken into consideration in addition to the initial cost, the crucibles are actually much cheaper than the iron pots.

Otherwise, we believe the author has fairly compared the relative merits of graphite crucibles and iron pots for melting aluminum.

RICHARD H. STONE
Sales Manager

Vesuvius Crucible Co.
Swissvale, Pittsburgh 18, *Pa.*

* * *

A Question of Mathematics

TO THE EDITORS:

Received my copy of the June issue of THE FOUNDRY yesterday and one of the first articles I noticed was the one on page 124 concerning AFA apprentice contest winners.

Of course I realize that your home office is in Cleveland and you must be loyal to that city for that reason, but I question very much your mathematics. I thought you learned enough in that Purdue schoolhouse to realize that first place in a track meet, a horse race or even an apprentice contest is better any time than a show or place position.

In the first paragraph of this article you say "Cleveland apprentices took major honors in the 1948 apprentice contest" and then you tone it down by saying that since first place in patternmaking and gray iron went to apprentices at Caterpillar Tractor Co., there might be some question of the respective ranking of the two cities. If you consider that one second and three third places are better than two firsts, then I wouldn't want you to be in charge of my apprentice program because I will take a first place any time and you can have all of the second or thirds you want.

Aside from all the ribbing, it was a very splendid contest and I am pleased that more interest is shown every year. I believe it is one of the finest things AFA does especially to create interest in foundry apprentice courses and we certainly need a lot more capable men.

F. W. SHIPLEY
Foundry Manager

Caterpillar Tractor Co.
Peoria, Ill.

* * *

Lost at the Convention

TO THE EDITORS:

During the Foundry Show in Philadelphia, I had the misfortune of losing my top coat. It was a dark gray, but since it was given me by my father I do not recall where it was purchased; however, believe it was Milwaukee. I could identify it by the fact that the sleeves have either two or three sewed lines around them near the end.

I was in the hope that the party who so very graciously appropriated it may return it or hear of this loss and decide to return it to me. The coat was lost in the Bellevue-Stratford Hotel on Monday night, May 3.

JOSEPH A. SIEGEL

Butler Bin Co.
Waukesha, Wis.

° ° °

Manganese Range Incorrect

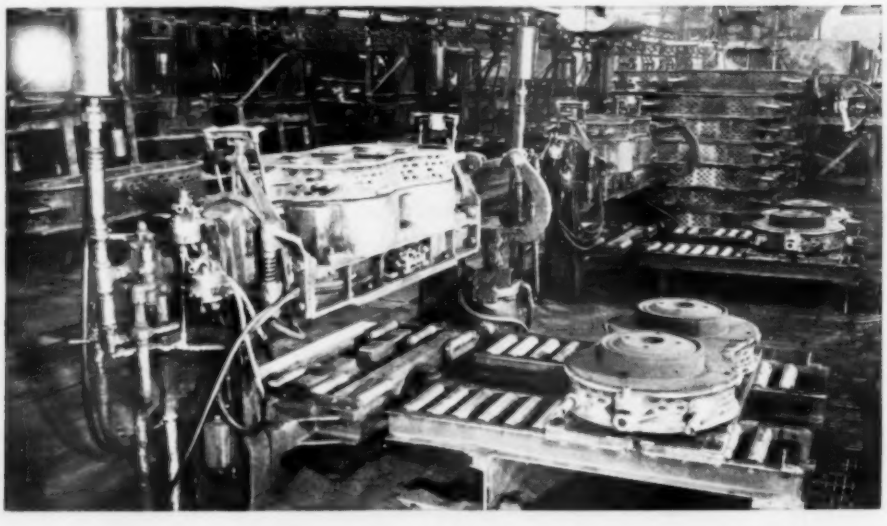
TO THE EDITORS:

The article dealing with ferrophosphorus which appears in the May issue of THE FOUNDRY carried one typographical error. It is stated "in both grades, manganese ranges from 4 per cent to 13½ per cent." This should read "from 4 per cent to 3½ per cent." As you will readily see, an addition of 13½ per cent manganese would more than offset the advantages of the phosphorus.

J. H. TRESSLER

Hickman, Williams & Co.
Cleveland

Squeeze for Speed in production of



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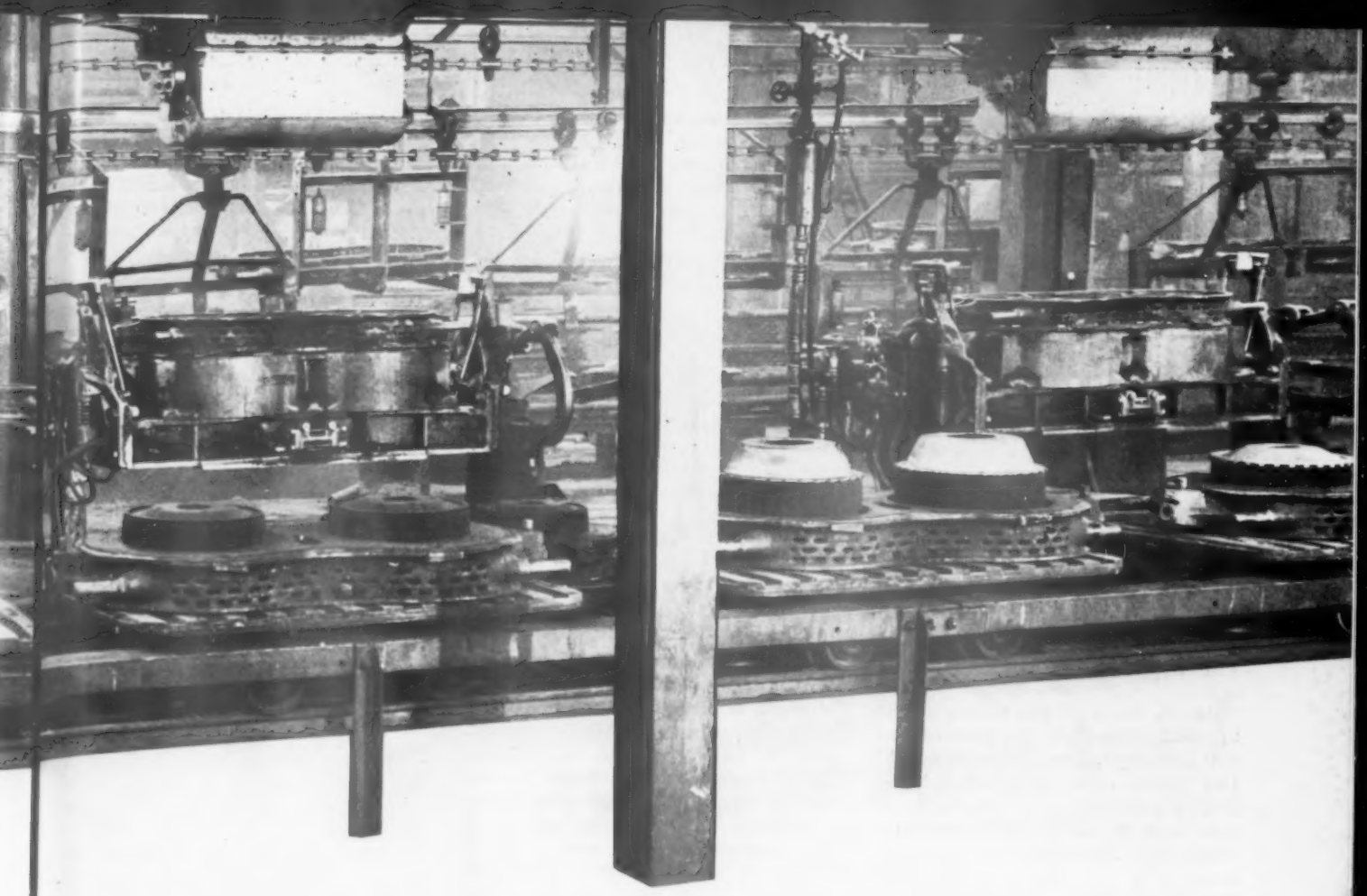

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MANUFACTURER'S ASSOCIATION, INC. FOUNDRY EQUIPMENT

WHAT IS STRENGTH?

(*Continued from page* 81)

deformation has occurred, again about 20 per cent in the example given. The area under the stress-strain curve does give the amount of energy necessary to fracture the metal, but this energy cannot be utilized in design, due to the necessity of adequate rigidity, and only 1 or 2 per cent elongation at the very most is required. Nevertheless, metals and forming methods are being evaluated and compared today by a factor called the "P" or quality factor, which is a relationship between tensile strength and—of all things—reduction of area. The really important values from the service standpoint—yield strength and modulus of elasticity—are usually ignored.

Take Test for Granted

Again, much of this fallacy is due to taking the test for granted and not keeping constantly in mind the two factors entering into any test—control and evaluation. Reduction of area is about the best tool known for controlling uniformity, for it is very sensitive to any change occurring in any given metal. Its usefulness in evaluating a metal or forming process is questionable, to say the least, for it is not operative in service. Therefore, evaluating two metals or two forming processes on the basis of reduction of area is ridiculous, when at the same time the use of reduction of area to control a number of lots of the same metal with the same heat treatment and formed by the same process makes sense.

From the standpoint of control the tension test is therefore a worthwhile tool. It is relatively cheaply and easily made, it gives reproducible results and is very sensitive to changes occurring in the metal under test. Its only disadvantage from the standpoint of control is that it is destructive, and this is quite serious. From the standpoint of evaluation, the only properties measured by this test having any significance in design or in service are yield strength and modulus of elasticity. However, other tests and properties are needed for the evaluation of metals, for these two properties in themselves are not sufficient.

The classic example is a file-hard steel, a material with a very high yield strength, over 200,000 psi., but one that will not withstand service stresses nearly as well as a steel with a yield strength of only 30,000 psi. Evaluation of one other property boils down to one of ductility, that property measuring the resistance to brittle fracture and to fracture under suddenly applied loads. In the past, when the tensile test was the only one available, experience showed many times that metals with high elongation and reduction of area did withstand service loads and did not fail brittlely, whereas those metals exhibiting low elongation and reduction of area broke in service. This was the start of the fallacy of the tension test as an evaluation test. Simply because a property varies in some degree with another does not mean that it measures and evaluates the other. Just because elongation and reduction of area do vary in somewhat the same manner as serviceability under certain conditions does not mean that they measure and evaluate the ductility component of service strength.

Basically the reason elongation and reduction of area do not evaluate the ductility component of service strength is that the tension test is an ideal test. The specimen is uniform and is axially loaded in tension. Many precautions are taken in the test to insure the fulfillment of these conditions. The part in service is very seldom uniform and is never loaded in axial tension. This point has been known for years, but it has only been in the last 15 years that the implications of this difference have been appreciated, and even now they are not fully understood.

Introduce New Field

The recent work of Kuntz, McAdam, Sachs, Gensamer, Holloman and others have introduced not only a new field of physical metallurgy, but also a new language, abounding in words like triaxiality and equicohesive strength, to say nothing of formidable mathematical equations and weird diagrams. Even an introduction to this new subject would fill a large book, one that would be obsolete before it was printed, for the subject is so new and changing so fast.

As far as the foundryman is concerned, only one basic concept is important. The properties of any metal change markedly, depending on the manner in which it is loaded. Just how they change becomes complicated, to say the least, for there are infinite methods of loading and therefore infinite properties. Ductility changes the most, the range being from zero to those values encountered in the ideal tension test. This is important, for it checks with practical experience. It is an exception to find a service failure of any metal showing even a fraction of the ductility exhibited by the same metal in the tension test. It is unusual to find any dimensional change in a failed part, measured even in thousandths of an inch, much less the 10 to 60 per cent found in the tension test. This, in itself, is enough to damn the tension test as an evaluation test for service ductility.

Therefore, from the standpoints of service strength and ductility, the properties derived from the ideal tension test are of secondary importance to those properties under conditions of nonuniform loading—stress concentration — whether this stress concentration be due to a non-uniform part or to the loading itself. Changes in section—fillets, corners, keyways, threads, gear teeth—all result in stress concentration and are so prevalent in castings that it can be said that the important properties of all castings are those operative, not in the ideal tension test, but under conditions of stress concentration, regardless of how the casting is loaded.

Test Bridge Cables

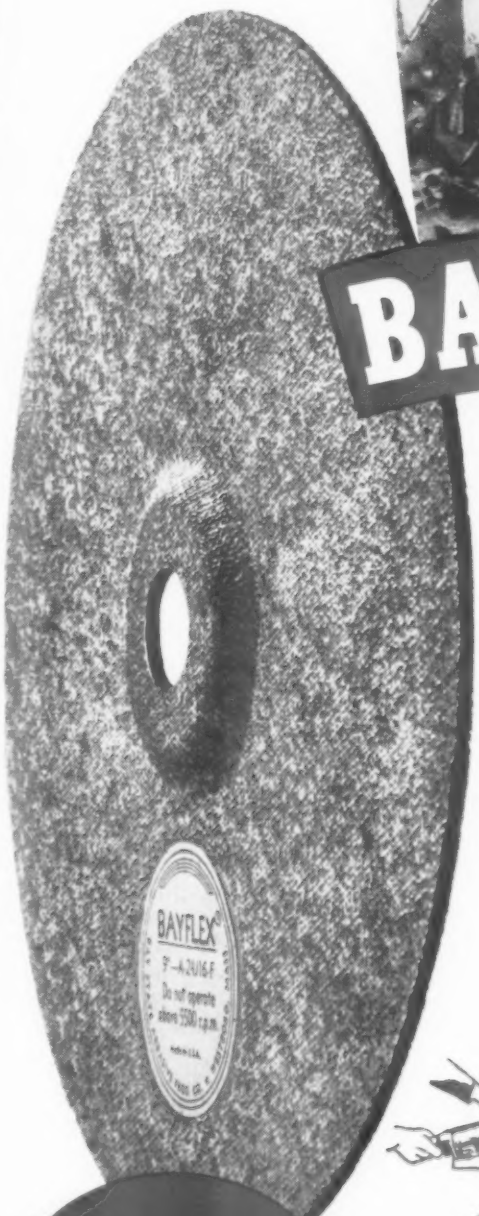
For that matter, it is doubtful if any part in service is loaded as a uniform section in axial tension as is the tensile test specimen. One of the very few structural members that seems to fulfill these requirements is suspension bridge cable. These cables are subjected to a static load and are flexible and long enough to adjust themselves to the load, which then closely approaches axial tension. It is significant that in two recent expensive but, fortunately, unspectacular suspension bridge cable failures —those of the Ambassador and Mt. Hope bridges—the cables broke brittlely, with practically no elongation or reduction of area. Tension test specimens cut from the wire as close to the failures as possible showed normal high elongation and reduction of area. Nonuniform loading and stress concentration occurred in even these cases, for the wires broke at tiny surface irregularities, probably caused by a new method of processing.

The spectacular change in properties of a metal when loaded in tension under conditions of stress concentration is illustrated in Fig. 2. This is an alloy cast steel, tensile stress concentration being induced by notching the test specimen. Successively sharper notches inducing increasing stress concentration are plotted, as illustrated at the bottom of Fig. 2. As would be expected, the ductility, as measured by elongation and reduction of area, falls off sharply as the severity of the notch and stress concentration increases.

It is surprising how fast so-called ductility decreases. The elongation

(*Continued on page* 150)

Christopher Columbus landing in the New World October 12, 1492.



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(*Continued from page* 148)

has fallen to less than 5 per cent with a notch radius of ⅛-in., the stress concentration being about the same as at a change in section with an ⅛-in. fillet. At the sharpest notch there is practically no ductility. It should be emphasized that the stress concentration at even the sharpest notch is no more than that encountered continually in service at the roots of threads, sharp cornered keyways and even at tool marks in a poorly machined uniform surface. In service, the ductility of a metal is therefore nearly zero, not nearly what would be expected from the ideal tension test.

Another surprising fact in all this type of testing is that the yield and tensile strengths increase with increasing stress concentration, sometimes continuously, sometimes to a maximum, falling off under conditions of severe stress concentration. The two examples shown are from the same steel with two different heat treatments. Surprisingly, the slowly cooled specimens, which often are the most ductile in the standard unnotched tension test, show decreasing strength under conditions of extreme stress concentration, whereas the harder quenched specimens show constantly increasing tensile and yield strength values.

All metals, whether cast or wrought, with the exception of cast iron, show this behavior to a greater or lesser degree. All show practically no ductility under extreme stress concentration. Many of the soft ductile metals—pure copper is an example—are very notch sensitive and show a marked decrease in strength as the concentration of stress increases. Many of these soft annealed metals are so sensitive to stress concentration that under high stress concentration their strength drops below that expected and obtained in the standard unnotched tension test.

It makes no difference how this stress concentration is obtained. A number of stresses acting on a uniform section in different directions will induce the same properties in the metal as stress in only one direction on a nonuniform section. The end result is stress concentration, practically no deformation regardless of the material, and brittle fracture if the strength of the part is exceeded. If a sphere is loaded hydrostatically to failure it will fail brittlely with no deformation; in fact, it will shatter no matter how ductile the metal. A cylinder made of the same metal and loaded in the same manner to failure will deform and probably split. The metal will fail in a ductile manner and not shatter.

Load Makes Cylinder Bulge

The reason for the difference in failure is that although each square inch of the cylinder carries the same load, there are fewer square inches in the ends than in the side. Therefore the load parallel to the axis of the cylinder is less than that at right angles to the axis. This larger load at right angles to the axis makes the cylinder bulge, the smaller load acting on the ends allows the ends to draw together, as they must if the sides are to bulge. There is an opportunity for deformation and the failure will be ductile.

In the case of the sphere the load in all directions is equal, for the number of square inches in any direction is the same. There is no opportunity for one part of the sphere to deform to allow deformation in another direction. It is impossible to have deformation in only one direction, for that would be making matter. In the case of the sphere the load is equal in all three principal directions, and the sphere is loaded in what is known as triaxial stress. Under these conditions there can be no deformation, no matter how ductile the metal and the sphere fails brittlely.

Exactly the same conditions prevail at changes in section, fillets and at the base of threads. The small amount of metal at these points is supported by other metal of a larger section and therefore at a lower stress level. If the metal at these points is stressed above its yield point, it cannot elongate to distribute the stress, for elongation cannot occur

(*Continued on page* 152)

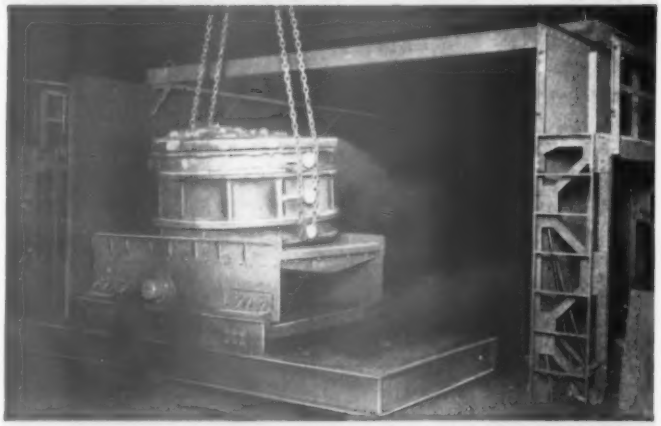
New Foundry Starts Operations

NEW gray iron foundry of Sharon Industries Inc., Sharon Wis., recently started production of castings for its parent company, Sta-Rite Products Inc., Delavan, Wis., manufacturer of pumps and water systems for domestic and industrial use. Accompanying illustration shows the transfer of molten iron into a receiving ladle at the cupola of the new $150,000 plant. Sharon Industries Inc. was formed last year and has the following officers: Chairman, W. C. Heath, president, A. O. Smith Corp., Milwaukee; president, Henry S. Lauterbach, president, Sta-Rite Products Inc.; vice president and general manager, Edwin S. Armstrong; secretary-treasurer, M. J. Herrmann; assistant treasurer, V. G. Baker.

SIMPLICITY portable shakeouts handle loads from 500 to 100,000 lbs.

For plants where there are no facilities to take work to the shakeouts, Simplicity builds shakeouts that can be taken to the work. For example, the self-propelled 4′ x 8′ Simplicity Shakeout illustrated travels on a sandslinger track in a Chicago foundry, hoisting flasks to the vibrating deck and quickly shaking the castings free while ejecting the sand in windrows between the tracks. This unit has a safe load capacity of 5,000 lbs. and can be built in capacities up to 16,000 lbs.

Any standard size Simplicity Shakeout may be made portable by mounting on a cast or I-beam frame, and it will operate as efficiently as in a permanent installation. Let us review your shakeout requirements. If portability is required, we'll show you how portable Simplicity Screens—from 2′ x 3′ units of 500 lb. capacity to 15′ x 25′ models of 100,000 lb. capacity—will do more shakeout work for you in less time and for less money. Write for complete particulars.



simplicity
TRADE MARK REGISTERED

ENGINEERING COMPANY, DURAND, MICHIGAN

- SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A. o FOR CANADA:
- CANADIAN BRIDGE ENGINEERING CO., LTD., WALKERVILLE, ONTARIO.
- FOR EXPORT: BROWN & SITES, 50 CHURCH ST., NEW YORK 7

(*Continued from page* 150)
without reduction of area. As the larger sections around the notch are stressed at a lower level they will not reduce in section to allow elongation. The metal at these points is stressed the same way as that of the sphere, in triaxial tension, and if its strength is exceeded it will fail brittlely, with no deformation, many times showing a coarse crystalline fracture.

Temperature Important Variable

Dynamic loading, impact, simply exaggerates the foregoing conditions; the faster the loading the more sensitive the metal becomes to stress concentration. It simply takes a little time for deformation to start. Temperature is another important variable; the lower the temperature the more sensitive most metals are to stress concentration. It does not take a high degree of dynamic loading to change the picture completely from that acquired from static testing as performed in the tension test. Most steels, even those known to be notch sensitive, behave as does the annealed steel in Fig. 2. The strength rises to a maximum and then decreases, but the strength with even the sharpest notch is higher than that shown by the standard unnotched tension test bar. This seems to be true down to temperatures as low as −100° F. However, one of these sharply notched specimens made of notch brittle metal and cooled to −100° F will break when merely dropped about 6 in. onto a concrete floor. The bar will break brittlely with a coarse crystalline fracture. A companion bar will not break in the tension machine at standard speeds of loading until it has been stressed to a higher level than the standard tension test bar with a uniform section.

It therefore seems that some sort of dynamic loading is needed in our search for a test that will evaluate the ductility factor in service strength. One such test has been known for years, the so-called impact test. Again, the implications of the test have not been appreciated until just recently. The test is not simply a test that measures the resistance of the metal to fracture when subjected to dynamic loading, for the specimen is notched. The correct name is notched impact test. The test actually measures the resistance of the metal to stress concentration induced by the notch, when subject to dynamic loading. Notched impact testing is then a step advanced from notched tensile testing in that dynamic loading is introduced and it therefore approaches service conditions more closely than does any type of slowly loaded tension testing.

Many instances are cited in the literature where notched impact tests could be correlated with the behavior of the part in service when it failed suddenly, with a brittle fracture, even though the metal showed exceptional properties in tension. One typical instance concerned large channels used as the framework of large earth moving equipment. The channels failed suddenly and brittlely in zero weather when the machine ran over a curb while being shipped, the wheels dropping about 6 in. Standard test specimens cut from the channels showed unusually high properties in tension, whereas the resistance to fracture in the notched impact test at 0° F, the temperature at which the part broke, was practically zero.

The much publicized failures during the war of welded ships were due to the same conditions, although in these cases the problem is complicated by stresses induced by welding. The steels that failed showed acceptable standard tensile properties but low resistance to stress concentration as measured by the notched impact test. In many cases this low resistance to service stresses resulted from the insistence for slow cooling in the specifications.

The foundryman should be vitally interested in these facts, not only objectively in an effort to make a better product, but also selfishly, for cast metals and castings show up much better competitively in the notched impact test as an evaluation of service ductility than in the standard tension test. The iron foundryman has an additional interest, for his product is the one that shows up the worst in the tension test and at the same time is the one common metal that is not notch sensitive, statically or dynamically. This is a point he should exploit, not be afraid of, as he has in the past.

Notch Impact Test

If the notched impact test is to be accepted as a possible substitute for the tension test as a method of evaluating service ductility, it should be examined from the standpoint of control and evaluation, in the same manner as has been done with the tension test. From the standpoint of control the test has the same disadvantage as has the tension test—it is destructive. From the same standpoint of control the test specimen is not as easily made as the tension test specimen, but this disadvantage is not too serious. The most serious objection from the control standpoint is the much poorer reproducibility of the notched impact test. The test must be made in duplicate or triplicate and it is not unusual to find a variation of 25 per cent in the values obtained from individual test specimens. Whether this variation is due to slight differences in the machining of the individual specimens, the test itself, or unknown variations in the metal is not too well established.

The notched impact test has the great advantage of evaluating a property that is required many times in

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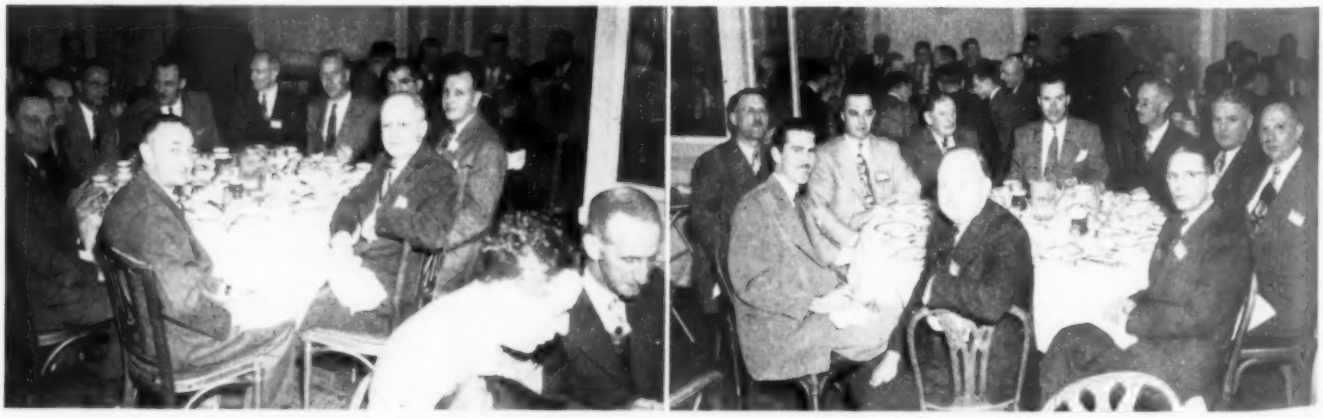
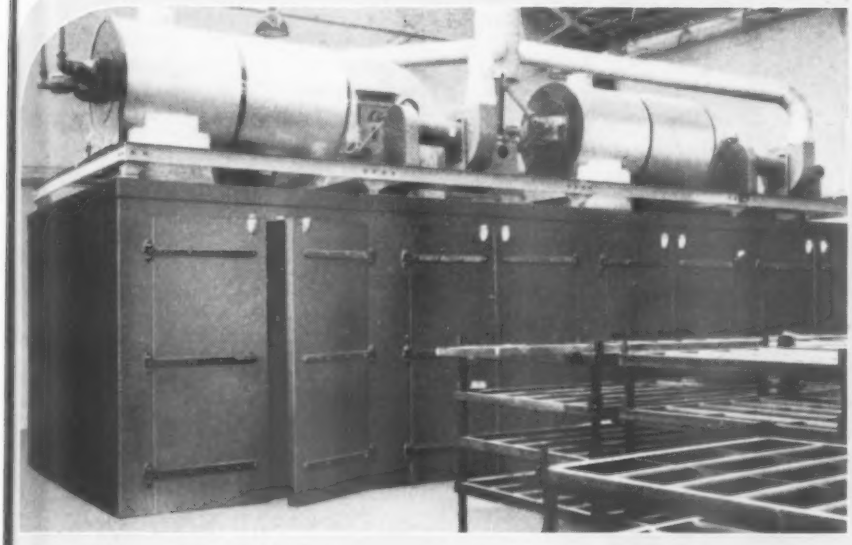


AT PHILADELPHIA: Some of the participants in the annual dinner of AFA chapter officers and directors held during the recent convention in Philadelphia

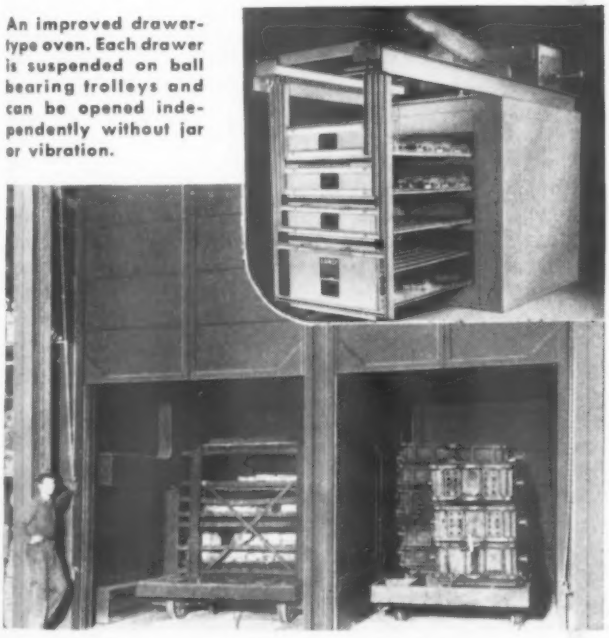
LANLY *Dual Fuel* OVENS



A four-unit rack-type oven with each compartment individually heated.

THOROUGHLY PROVEN
•
TIMELY
•
EFFICIENT
on either Gas or Oil
•

An improved drawer-type oven. Each drawer is suspended on ball bearing trolleys and can be opened independently without jar or vibration.



A typical Lanly car type mold drying oven. Each compartment is individually heated and controlled.

REGARDLESS of what fuel change-over crisis the morning may bring, no interruption of production will be entailed if you install LANLY Dual Fuel OVENS. The switch from gas to oil, or vice versa can be made in a matter of seconds by turning two valves and throwing a switch.

So efficient and satisfactory are these ovens that most recent Lanly foundry installations have been of this Dual Fuel type.

The Lanly recirculating, convection type heater is not only highly efficient but uncommonly versatile as to installation.

This makes practical its application to ovens of other makes and the satisfactory modification of older equipment.

Isn't it time to do something about the fuel situation to avoid further difficulties and costly interruptions? If you need a new oven there is a Lanly exactly adapted to every requirement. If you have equipment that can possibly be modernized Lanly consultation is available without obligation.

Fill in—clip—and mail the coupon for information.

THE LANLY CO.
OVENS FOR INDUSTRY
HEATED BY GAS, OIL, ELECTRICITY OR STEAM
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The LANLY Co.
Cleveland, Ohio

☐ Send information regarding Dual Fuel Ovens.

☐ Contact us regarding remodeling our ovens to use gas or oil.

☐ Have representative call when in this vicinity.

Company . . . . . .

Address . . . . . By . . . . . .

(*Concluded from page* 152)

service, a property that is not evaluated by the standard tension test. One disadvantage this test shares with the standard tension test is that it does not evaluate service ductility in pounds per square inch, values that can be used directly in design. The results are only comparative, but so are elongation and reduction of area. This brings up an important point, one that has given much trouble in the past; an unconscious psychological urge to strive and ask for the largest number possible, without thinking if the largest number is necessary or desirable.

Little Strength Required

Both supplier and consumer should be interested in how much notched impact strength is really necessary. All evidence to date shows that surprisingly little is required—in the neighborhood of 10 foot pounds at the lowest temperature to which the part is to be subjected. And this value is required only for the so-called ductile metals and then only when subjected to the more severe service conditions. It is to the advantage of both supplier and consumer, from the cost standpoint, if nothing else, to resist the natural human impulse to want the highest number possible. Notched impact strengths much higher than 10 foot pounds can be obtained easily with most of the ductile metals, but the cost increases as the value specified increases. For example, it has been reported that certain steel castings used on tractors failed when a heat treatment yielding 2.5 to 12 foot pounds notched impact strength (Charpy keyhole specimen) was used. Failures were practically nonexistant when the heat treatment was changed to yield 8 to 17 foot pounds.

Cast steel can be made and heat treated to 30 foot pounds using a Charpy keyhole specimen, but the alloy content and heat treatment required would be more expensive. Perhaps another application would require higher properties, but unless it is proved that they are required, money and time spent obtaining the maximum are wasted. The part is more expensive than required and from the standpoint of competitive quality, as stated in the first paragraph, is of inferior quality.

(*To be concluded next month*)

Foundry Equipment Manufacturers Association, Cleveland, reports that the index of net orders closed on new foundry equipment was 326.2 for March, 367.3 for February and 380.9 for January.

OBITUARY

ELLIOT R. JONES, 48, plant superintendent, Lumen Bearing Co., Buffalo, died June 6. Mr. Jones, a native of Aberdeen, Md., entered the nonferrous foundry industry as a pattern clerk at Lumen Bearing Co., in 1916. After working in various departments he was appointed

ELLIOT R. JONES

plant superintendent in 1939. An active member of the Western New York Chapter of the American Foundrymen's Association, he served as its chairman last year.

* * *

James J. Hughes, 67, for the last 26 years sales agent in Chicago for the Ohio Steel Foundry Co., Lima and Springfield, O., McConway & Torley Corp., Pittsburgh, and Davis Brake Beam Co., Johnstown, Pa., died May 18 in Chicago. Mr. Hughes was born in Des Moines, Iowa, and previously had been associated with American Steel Foundries at Franklin, Pa., and Chicago.

* * *

Paul A. Jaeschke, 69, retired foundryman, died Apr. 22, in Milwaukee. Mr. Jaeschke was president of the former Jaeschke Bros. Foundry Co. there, which he founded. The company was sold to the Koehring Co., Milwaukee, when he retired in 1920.

* * *

W. D. James, 66, president, James Mfg. Co., Fort Atkinson, Wis., died Apr. 16 in Madison, Wis. Mr. James founded the company in 1906.

* * *

Hiram J. Leonard, 67, director of Willys-Overland Motors Inc., Toledo, O., and chairman of its subsidiary, Wilson Foundry & Machine Co., Pontiac, Mich., died May 17, in Toledo. Mr. Leonard was president, F. B. Stearns Co., Cleveland, at the time of its liquidation in 1929. He was an officer of Moline Plow Co., when Willys-Overland acquired it in 1922. Later he went to Toledo with Willys-Overland as vice president.

* * *

Joseph L. Hecht, 80, retired head of the former French & Hecht Inc., Davenport, Iowa, now a division of Kelsey Hayes Wheel Co., Detroit, died June 3, following a long illness. Mr. Hecht, a resident of Davenport for over 40 years, had been active in civic affairs there. He designed the Davenport roller bearing wagon, a revolutionary idea in its time.

* * *

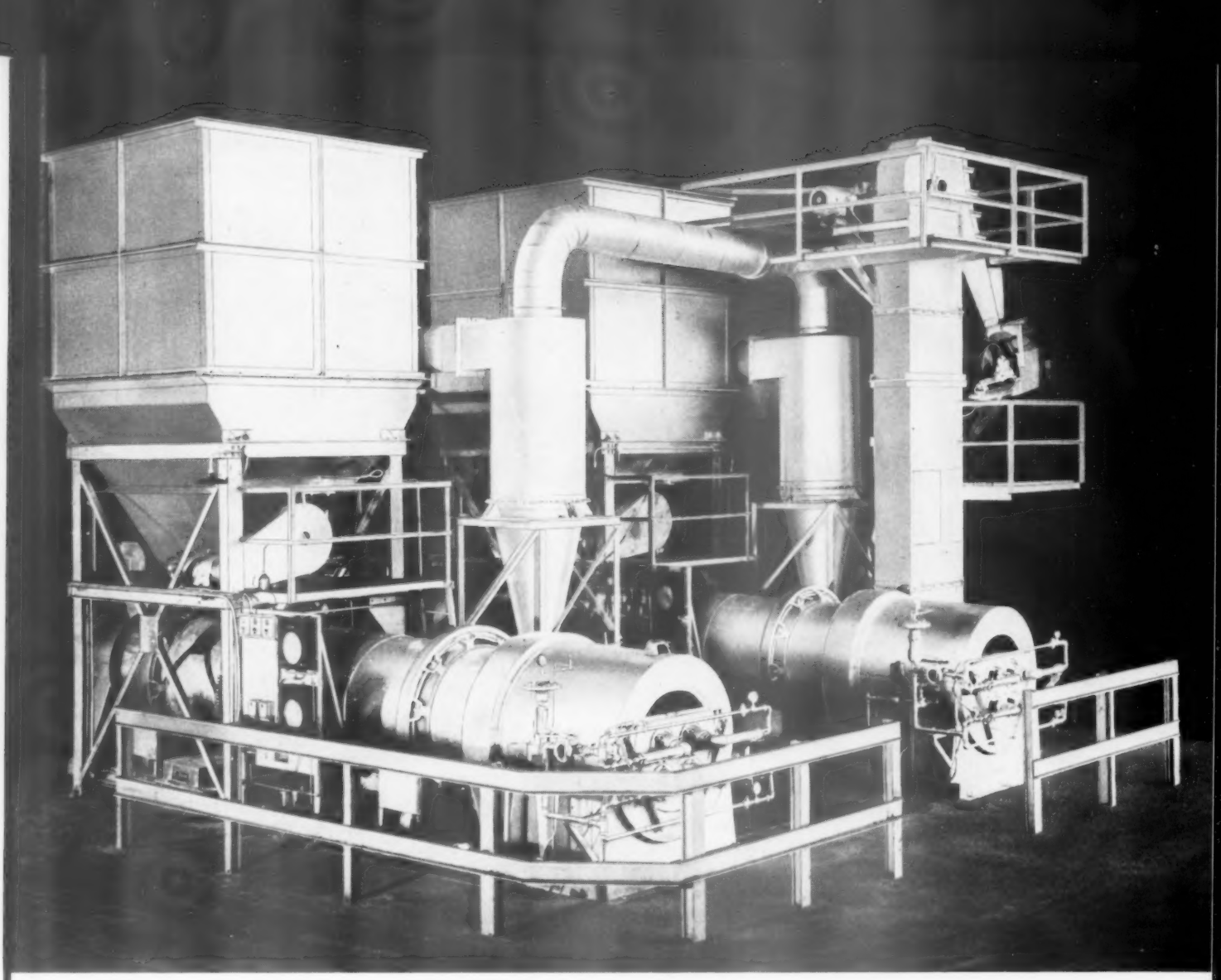
Fred T. Gray, 54, vice president, Youngstown Foundry & Machine Co., Youngstown, O., died May 10, at his home there. Mr. Gray, a native of Youngstown, had been associated with the company for 36 years. He served as a clerk and timekeeper prior to becoming vice president.

Lighting Equipment Specifications

RLM Standards Institute, 326 West Madison St., Chicago 6, has announced the second edition of its specification guide for electrical contractors, utility lighting men, and all others interested in proper planning of lighting for industry, business, etc. Entitled the "RLM Standard Specifications for Industrial Lighting Units," the 36-page booklet contains detailed specifications for commonly employed incandescent and fluorescent lighting units. Specifications cover materials, shielding and brightness, efficiency, auxiliary control equipment, ballast temperatures, reflection factor, construction, photometric performance, National Electric Code requirements, and other subjects. Copies of the guide are available upon request.

Moves Headquarters

Western Society of Engineers, formerly located at 205 West Wacker Drive, has moved to its new headquarters at 84 East Randolph St., Chicago. Establishment of a research center is anticipated where engineering organizations may gather. The center will be housed on the fourth floor of the Taylor Building while structural and interior changes are being completed on the fifth, sixth and seventh floors. W. V. Kahler is president of the society. Other organizations of similar interests and professional standards will be invited to share in the expanded headquarters.



Drying Core Sand to less than ½ of 1% moisture

DRYING of core sand offers many present day advantages. It permits the use of undried sand from many different sources of supply, resulting in better deliveries, more favorable prices and lower freight rates. It eliminates all variation in the moisture content going into the mix, permitting exact control of each ingredient, and exact duplication of any mix time after time, by different operators. Core blower operations do not suffer from overwet mixes. Dried sand disperses more readily in the mix, saving on binders and core oil. Core structure benefits from a uniform bake, reducing scrap losses due to core failures.

The installation pictured above, which has been operating in a midwest foundry for about five years, consists of two complete and self contained systems installed side by side. Either unit can be operated singly by itself, or both units can be operated together, depending upon the plant requirement.

The wet sand is loaded into the storage bins with a clam. It is fed into the dryers, each 48" in dia. by 20' long with variable speed feeders. The dried sand is discharged on to a belt conveyor—is carried to the elevator—and then to the core room on a second belt conveyor. The burners are automatically controlled to save fuel, and to assure the discharge of a sand of uniform dryness regardless of variations in the rate, or moisture content of the feed. Fines are caught in a Bartlett-Snow cyclone dust collector and returned to the system again.

Economical and dependable, this installation reflects the advantage of Bartlett-Snow's intimate familiarity with the needs of practical day-to-day foundry operation. Let the Bartlett-Snow foundry experts work with you on your next sand, mold and castings handling problem. The C. O. Bartlett & Snow Co., Cleveland 5, Ohio. Engineering representatives in New York, Baltimore, Detroit and Chicago.

BARTLETT-SNOW
CLEVELAND 5, OHIO

DESIGNING AND CONTRACTING ENGINEERS

For the Foundry Industry

SAND, MOLD AND CASTINGS HANDLING EQUIPMENT

ACTIVITIES OF FOUNDRY Groups

Wisconsin

WISCONSIN Chapter of the AFA held its annual dinner for the old timers and apprentices at Hotel Schroeder, Milwaukee, May 14 with a total attendance of 471, of which 103 were old timers (50 or more years at the foundry trade) out of a total of 160 of them still living.

Of those present, 37 became eligible for the 50-year group lately and were presented with plaques. Several of the old timers are still at work in foundries, one who received his plaque several years ago being active as "complaint man" in a foundry at age 72, after 59 years in the trade. Several others lay claims to 60 years of work but are no longer active. An hour before the dinner, the old timers were given a reception in the Banquet Room of the hotel, with free beer for all.

Of the apprentice graduates, twelve received cash prizes.

New officers of the chapter were installed at this meeting, as follows: Robert C. Woodward, Bucyrus-Erie Co., president; Arthur Haack, Wisconsin Grey Iron Foundry, vice president; Walter Edens, Badger Brass & Aluminum Foundry Co., secretary; and George Tisdale, Zenith Foundry Co., treasurer. All are from Milwaukee. The new terms of office start July 1.

The annual chapter outing will be held July 16.—*John E. Hubel.*

Birmingham

ELECTION of officers for 1948-49 was held by Birmingham Chapter of the AFA at its May meeting. They are: James T. MacKenzie, technical director, American Cast Iron Pipe Co., Birmingham, chairman; C. D. Caldwell, president, Caldwell Foundry & Machine Co. Inc., Birmingham, vice chairman, and Fred K. Brown, sales manager, Adams, Rowe and Norman, secretary-treasurer.

New directors are: D. C. McMahen, J. A. Bowers, Donald C. Abbott, Clyde E. Haigler, B. W. Worthington and W. E. Jones, all of Birmingham, and Paul F. Singleton, Holt, Ala.

William W. Austin Jr., research metallurgist, Southern Research Institute, Birmingham, was the principal speaker for the technical session which followed the regular dinner meeting.

In his talk Dr. Austin declared experiments conducted on a laboratory scale within the Southern Research Institute have resulted in improved machinability of a high-phosphorus iron by about 40 per cent. The experiments were sponsored by the Woodard Iron Co. The problem of poor machinability has held back the use of high-phosphorus iron in the automotive and similar industries, according to Dr. Austin.

W. E. Jones, chief engineer, Stockham Pipe Fittings Co., Birmingham, retiring chapter chairman, presided and delivered a report of the recent season's activities. The financial report showed the chapter in sound financial condition. The fine work of the membership committee under the leadership of Donald C. Abbott gained 83 new members during the year, which resulted in a net increase in membership of 44. There was a loss of 15 members to the newly organized Tennessee Chapter, along with several other transfers.—*J. Pat McClendon, Stockham Pipe Fittings Co.*

Rochester

ROCHESTER Chapter of the AFA celebrated "Tribute Night" May 11 at Hotel Seneca, Rochester. Guest of honor was Dave Baxter, Sterling Wheelbarrow Co., who has had 50 years of foundry experience. Tall stories and several appropriate gifts were presented as the career of this smiling Scotchman was reviewed for the assembled members.

It was also the occasion for the annual business meeting and election of officers. Those elected were all from Rochester, and are: M. T. Ganzauge, General Railway Signal Co., president; Herman Hetzler, Hetzler Foundries Inc., vice president, and Leon Kimpal, Rochester Gas & Electric Co., secretary-treasurer.

Directors, also of Rochester, elected to serve until 1951 are: Ken Proudt, Anstice Co.; William Ricter, Gleason Works, and Fred Gehron, Southern

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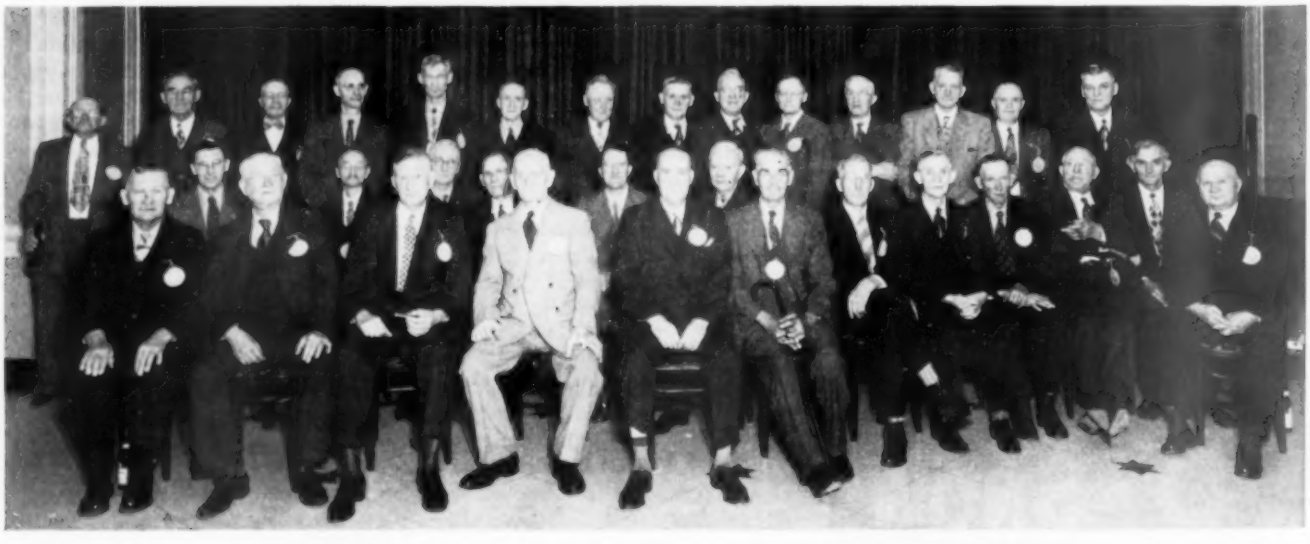
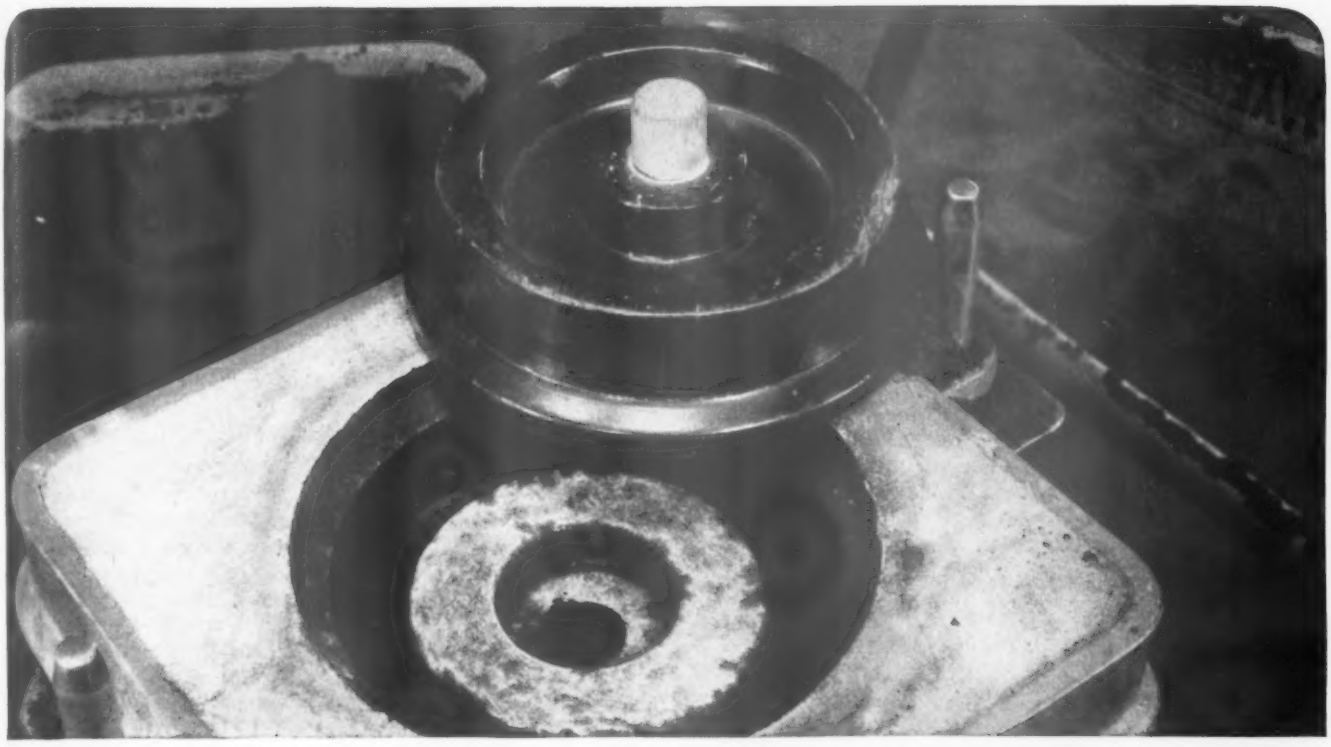
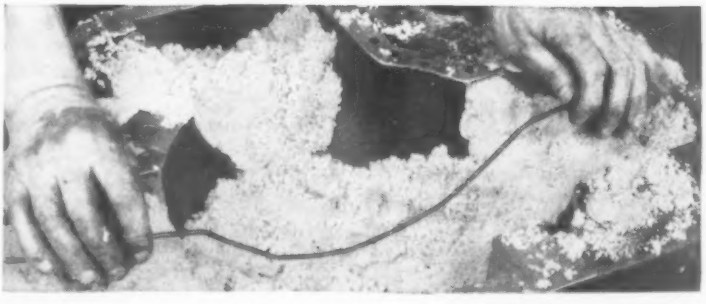


NEW MEMBERS of the old timers' group at Wisconsin Chapter of the AFA



gives sharp edges



KORDEK's collapsibility is another advantage. Gases permeate KORDEK easily and evenly.

KORDEK cleans easily, doesn't adhere to surfaces of castings or core boxes.

● Sharp edges, soft interiors, permeability and easy drying are just a few of the advantages you get when you use KORDEK.

When you consider KORDEK's reduced baking time—and the fact that you can use KORDEK in smaller quantities than most dry binders, you realize what an economical product this is. And how it can help your profits by increasing production of perfect castings.

Write our Technical Division for consultation and information—without obligation.

Corn Products Sales Company
17 Battery Place, New York 4, N. Y.

KORDEK

(*Continued from page* 156)

Wheel Division, American Brake Shoe Co.

Technical speaker for the evening was Michael Bock, Exomet Inc., Conneaut, O., who spoke on "Shrinkage Problems." He stated the x-ray examination shows that analysis and gating systems are largely responsible for shrinkage and porosity in castings and discussed the use of exothermic materials as a riser addition and the use of insulating pads in overcoming these problems.—*G. M. Etherington, Gleason Works.*

* * *

On May 27 the chapter co-operated with the Paul Revere Trade School in an open house program at the school. Harold Hershey is instructor in the foundry and pattern-making courses at the school which has facilities for casting brass, bronze, aluminum and gray iron. The course also includes visits to foundries in the area.

At noon on the same day, directors of the Rochester Chapter had a luncheon meeting with Verne A. Bird, assistant superintendent of schools, Frederick O. E. Raab, principal, Paul Revere Trade School, and Mr. Hershey. Several topics were discussed, the main ones being: Co-operation between the school and the chapter, interesting desirable boys in the foundry course, establishing a co-operative system between the school and local foundries, and giving a foundry course to boys majoring in other lines to broaden their outlook and to give them a better knowledge of foundry problems.—*L. C. Gleason, Gleason Works.*

CENTRAL ILLINOIS Chapter of the AFA elected officers at its May meeting. Shown seated, left to right, are: Ed Roby, Peoria Malleable Castings Co., Peoria, Ill., technical chairman; J. A. Durr, Albion Malleable Iron Co., Albion, Mich., guest speaker; and Frank Shipley, Caterpillar Tractor Co., Peoria, chairman. Standing, left to right, are: A. V. Martens, Pekin Foundry & Mfg. Co., Pekin, Ill., retiring chairman, and Charles Bucklar Jr., Superior Foundry Co., East Peoria, Ill., vice chairman

Central Illinois

CENTRAL Illinois Chapter of the AFA at its meeting May 17 at Hotel Jefferson, Peoria, Ill., heard J. A. Durr, Albion Malleable Iron Co., Albion, Mich., talk on malleable foundry practice, stressing the importance of controls by the use of standards.

According to the speaker, the main phases of foundry problems such as melting procedures, sand, gates, risers, molding practices, cleaning procedures, annealing, and others, can all be set up under one standards department. This, of course, necessitates periodic testing and checking of sand and melting. The amount of jolting and squeezing of different kinds of molds comes under this standards department. In some cases production can be increased by eliminating unnecessary jolting and squeezing.

The gating and risering standards not only increase yield but help in pattern layout. Mr. Durr also suggested some ways of combating shortages in coal, coke and pig iron by hot blast methods of melting through utilization of the hot gases that ordinarily escape out the stack. Several interesting slides were shown along with the talk.

Newly elected officers for the coming year are: F. W. Shipley, Caterpillar Tractor Co., Peoria, Ill., chairman; Charles Bucklar Jr., Superior Foundry Co., East Peoria, Ill., vice chairman; Vern W. Swango, Caterpillar Tractor Co., Peoria, secretary-terasurer.—*Vern W. Swango, Caterpillar Tractor Co.*

Northeastern Ohio

AWARDING of prizes to apprentice contest winners, nomination of officers for the coming year and two speeches comprised the dinner meeting of Northeastern Ohio Chapter of the AFA, Apr. 8, at the Cleveland Club, Cleveland.

Apprentice contest winners are: Gray iron division—John Valichnac, Fulton Foundry & Machine Co., first; John Coreno and Albert Pucillo, Hill Acme Co., second and third, respectively. Pattern manufacturers group—Howard Rand, Aluminum Co. of America, first; Louis Jurkiewicz, Modern Pattern Co., second, and Carl

(*Continued on page* 160)

TWO MEXICAN GRAPHITE PRODUCTS THAT WILL INCREASE PROFITS AND QUALITY IN YOUR FOUNDRY

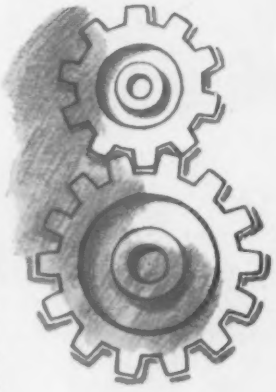
MEXITE BRIQUETTES

SAVE PIG IRON COSTS

Weighing only 4 lbs. each and yielding as much graphitic carbon as 50 lbs. of pig iron, Mexite Briquettes help reduce melting costs by allowing the use of more cheap scrap. Mexite is put in with the steel in high steel charges, and in coke splits when using 100% scrap. Twenty Mexite Briquettes thrown in below the tuyeres when making up the coke bed and four introduced with each ton of metal charged will hold the carbon closer to specifications and act to replace 200 lbs. of pig iron per ton of charge with normal operation.

NO. 8 MEXICAN GRAPHITE

SAVES MACHINING COSTS



If you are pouring light sections and want good machineability, low hardness, and no chilled edges, add 2 lbs. of No. 8 Mexican Graphite to each ton of metal, or less, by trickling at the spout or tossing into the ladle while filling. At a cost of less than 10c per ton, No. 8 Mexican Graphite eliminates the need for annealing and reduces cleaning room and machine shop expense. Write for full information and metallurgical assistance in increasing profitable production in your foundry with Mexite Briquettes and No. 8 Mexican Graphite.

THE UNITED STATES GRAPHITE COMPANY • SAGINAW, MICHIGAN

NEO CHAPTER OFFICERS: Shown left to right—Howard C. Gollmar, Elyria Foundry Division, retiring president of Northeastern Ohio Chapter, AFA; F. Ray Fleig, Smith Facing & Supply Co., treasurer; Elmer C. Zirzow, National Malleable & Steel Castings Co., president-elect; Walter E. Sicha, Aluminum Co. of America, vice president-elect; Robert D. Walter, Werner G. Smith Co., secretary

(*Continued from page* 158)

Eppich, Standard Pattern Works, third.

Nonferrous division—Elmer J. Turk, Wellman Bronze & Aluminum Co., first; Paul Kuches and Andrew Gerda, Cleveland Trade School, second and third, respectively. Steel division—Frank Alabaise, Edward Podnar and Nick Kraynak, West Steel Castings Co., in that order.

Officer and director nominations for 1948-49 are: President, Elmer C. Zirzow, National Malleable & Steel Castings Co.; vice president, Walter E. Sicha, Aluminum Co. of America; secretary, Robert D. Walter, Werner G. Smith Co., and treasurer, F. Ray Fleig, Smith Facing & Supply Co.

For director, with terms expiring in 1951, are: Lewis T. Crosby, Sterling Wheelbarrow Co.; Maurice F. Degley, Ferro Machine & Foundry Co.; Henry C. LeBeau, Ohio Injector Co.; Lloyd W. Leeseberg, Superior Foundry Inc., and John A. Sharrits, Westinghouse Electric Corp. Frank L. Barton, Fulton Foundry & Machine Co., has been nominated to fill the unexpired term of Mr. Sicha.

Clement J. Freund, dean of the College of Engineering, University of Detroit, discussed opportunities in the foundry industry. He said that, in the past, few young men had thought about a foundry career. For that reason, there is a shortage of adequately prepared young men in the industry to fill the vacancies which develop.

He went on to say that increased interest in foundry research should stimulate foundry growth. He anticipates a boom in the industry and scientific research and progressive thinking will help to bring the boom. In fact, such research and thinking are necessary if the foundry industry is to make great advancement over competitor industries.

William J. Moore, assistant director, Apprentice Training Service, U. S. Department of Labor, spoke on "Apprentice Training in the Foundry." He stated that his purpose was to sell the establishment, extension or improvement of apprenticeship in the northeastern Ohio area.

In referring to the work of his organization he said that it was instrumental in setting up basic standards for determining what an apprentice is, with reference to term of apprenticeship, content of apprenticeship training, wage schedules, related school instruction, supervision, and other items which are basic if an apprentice trainee is to be converted into an all-round skilled journeyman and Mr. Moore's organization is responsible for promoting the acceptance of those standards throughout the nation.

Old Timers Night of Northeastern Ohio Chapter, AFA, held May 13, brought out a total attendance of 300, including 94 of the district's old timers. More than a score of the latter had service records in the foundry industry of more than 50 years.

The meeting also was the occasion for honoring the 13 past presidents of the chapter and for presenting prizes to three of the award winners from Cleveland in the national AFA apprentice contest. Winners were John Valichnac, Fulton Foundry &

(*Continued on page* 162)

CENTRAL INDIANA: In attendance at the Apr. 5 meeting of Central Indiana Chapter of the AFA at the Athenaeum, Indianapolis, were, left above: J. P. Lentz, foundry metallurgist, International Harvester Co., Indianapolis. At top right is William McFerrin, metallurgist, Electro-Metallurgical Co., Detroit, main speaker at the meeting. Speakers' table is shown at the bottom. Photos courtesy staff photographer, International Harvester Co., Indianapolis

Photo Courtesy of Hines Flask Co.

Famous CORNELL CUPOLA FLUX

Cleanses Molten Iron

Besides, it makes metal hotter, more fluid, and reduces sulphur. You will pour castings that are denser grained, stronger, sounder, cleaner and easier to machine.

Keeps cupolas cleaner. Bridging over is practically eliminated. Drops are cleaner. Life of lining is prolonged. Maintenance time and labor is reduced amazingly.

SCORED BRICK FORM enables you to flux a charge of iron in a few seconds. No digging out of container. No weighing. No measuring. No waste. Under average conditions you simply toss one brick into cupola for each ton charge of iron or break off a briquette (quarter section) for each 500 lb. charge.

Write for Bulletin No. 46-B

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Produces clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections are poured. Castings take a higher polish. NO FUMES! Exclusive formula prevents obnoxious gases. Metal does not cling to dross.

Famous CORNELL BRASS FLUX

Makes metal pure and clean, even when dirtiest brass turnings or sweepings are used. Produces castings which withstand high pressure tests and take a beautiful finish. Saves considerable, tin and other expensive metals. Crucible and furnace linings are preserved.

Famous CORNELL LADLE FLUX

Place a few ounces in bottom of ladle, then tap cupola. Metal is thoroughly cleansed, foreign impurities are easily skimmed off. Ladles are kept clean, there is less patching and increased ladle life. Metal temperatures are retained during transfer to molds.

(*Continued from page* 160)

Machine Co.; Frank Alabaise, West Steel Casting Co., and John Coreno, Hill Acme Co.

Nominations for new chapter officers and directors, as announced at the April meeting, were unanimously approved. Remainder of the evening was given over to entertainment.—*Robert H. Herrmann.*

Quad City

NATIONAL Officers' Night and election of officers was held by Quad City Chapter of the AFA May 17 at Fort Armstrong Hotel, Rock Island, Ill., with 130 members and guests present.

Max Kuniansky, retiring national AFA president, spoke on "Operation of a Production Foundry." His enthusiasm and clarity of expression made a fine impression on the chapter members. He was introduced by H. Bornstein, Deere & Co., Moline, Ill.

During a luncheon meeting earlier in the day at the Davenport Club, Davenport, Iowa, Mr. Kuniansky addressed a group of top management foundrymen in that area. He stressed the development and training of supervisory personnel and showed by lantern slides how his home organization, Lynchburg Foundry Co., Lynchburg, Va., gave importance to the delegation of authority to the various branches of foundry operations.

Officers elected for next season are: M. H. Liedtke, Farmall Works, International Harvester Co., Rock Island, chairman; E. P. Closen, John Deere Planter Works, Moline, vice chairman, and C. R. Marthens, Marthens Co., Moline, secretary-treasurer.

Directors for three years are: J. H. Nelsen, Mississippi Foundry Corp., Rock Island; R. E. Wilke, Deere & Co., Moline, and C. S. Humphrey, C. S. Humphrey Co., Moline.

Directors for two years: W. C. Bell, Frank Foundries Corp., Moline; H. L. Mead, John Deere Harvester Works, East Moline, Ill., and H. A. Rasmussen, General Pattern Corp., Moline.

Directors for one year: R. H. Swartz, Riverside Foundry, Bettendorf, Iowa; A. D. Matheson, French & Hecht, Davenport, Iowa; A. H. Putnam, A. H. Putnam Co., Rock Island, and C. L. Briceland, J. I. Case Co., Bettendorf.

Elected to the board of trustees are: R. E. Wilke, C. S. Humphrey and R. H. Swartz.—*C. R. Marthens, Marthens Co.*

No. Illinois and So. Wisconsin

FOURTH annual Old Timers' Night was celebrated by Northern Illinois & Southern Wisconsin Chapter of the AFA at Beloit Country Club, Beloit, Wis., May 11.

Foundrymen with over 50 years of service in the industry were honored and pins of recognition were presented to them. They are: Eli Johnson, John Burstrom, August Walborg, Gustave Luebke, Oscar Youngquist and Albert Tobian, all of Greenlee Bros. & Co.; Conrad Althans, National Sewing Machine Co.; Carl Anderson, Walfred Palm, Pasquale Calacarcio, William Ramlow and G. H.

(*Continued on page* 164)

NO. ILLINOIS-SO. WISCONSIN—Annual Old Timers Night was held by the Northern Illinois and Southern Wisconsin Chapter, AFA, at Beloit Country Club, May 11. Ben Claffey (top left), Acme Aluminum Alloys Inc., Dayton, O., was the speaker. Photos by John Bing, A. P. Green Fire Brick Co., Milwaukee

THE same exacting standards that apply to engineering "Electro" High Speed Grinding Wheels to their jobs, apply to engineering every "Electro" product to its job. From this point, we follow through with job-side co-operation by our Qualified Field Engineers who have done so much to help the metal industries to speed production, raise quality and improve safety factors. Ask us for informative literature concerning products in which you are especially interested; or, better still, let us send without obligation, a Qualified Field Engineer to co-operate with you at Job-side. Here are some of our products for the Metal and Ceramic Industries:

ABRASIVE WHEELS, *resin-bonded, high-speed;* REFRACTORIES; CEMENTS, *high-temperature;* ALLOYS; STOPPER HEADS; FURNACE COVERS AND LININGS.

NON-FERROUS FOUNDRIES
Additive Alloys; CEMENTS; Grinding Wheels; Furnace Covers and Linings; Crucible and Pedestal Blocks.

STEEL MILLS & SMELTERS
Grinding Wheels; Stopper Heads; Brick; CEMENTS; Furnace Covers and Linings; Crucibles and Pedestal Blocks.

BRASS ROLLING MILLS
Door Assemblies; Furnace Covers and Linings; CEMENTS; Grinding Wheels; Crucibles and Pedestal Blocks.

FERROUS FOUNDRIES
(*Steel, Malleable, Cast-Iron*)
Stopper Heads; Grinding Wheels, *high-speed;* CEMENTS.

HEAT TREATING & ANNEALING
MUFFLES, box type; CEMENTS; Hearth Tile; Muffle Tile.

FOR CERAMIC INDUSTRIES
Kiln Furniture; CEMENTS; *high-speed* Grinding Wheels; Muffle Parts; Plate Setters; Posts; Slabs; Tubes—*Rigid, Floating or Combination Construction.*

INDUSTRIES SERVED: AUTOMOTIVE (*trucks, autos, tractors, airplanes*); CERAMIC; CHEMICAL; CONSTRUCTION; FOOD; MINING; RAILROADS; SEWAGE DISPOSAL PLANTS; SHIPBUILDING; WATER WORKS; UTILITIES; GOVERNMENTS (*Federal, State, Municipal, Navy Yards and Arsenals*).

Electro Refractories & Alloys Corporation

344 DELAWARE AVE. — West Coast Warehouse LOS ANGELES — BUFFALO 2, N. Y.

Patent Applied for

(*Continued from page* 162)

Lundgren of Mattison Machine Works.

Also Roy Schofer, and Charles Palmer, Fairbanks, Morse & Co.; John Lonergan, George Crone and Patrick McEntee, of Geo. D. Roper Corp.; Levi Hallen, Davey Pump Corp.; Harry Meyers and Frank Clark, Yates-American Machine Co.; Dan Hallifey, Henry Horn, Hagbert Sorenson and Fred Kruger, of Beloit Iron Works; Arthur Loennis, Rockford Brass Works; William Gusloff, Woodmanse Mfg. Co.; August Christen, Arcade Mfg. Co.; Albert Budden, Sundstrand Machine Tool Co.; Jack Spearing, J. I. Case Co., and O. K. Anderson, Gunite Foundries Corp.

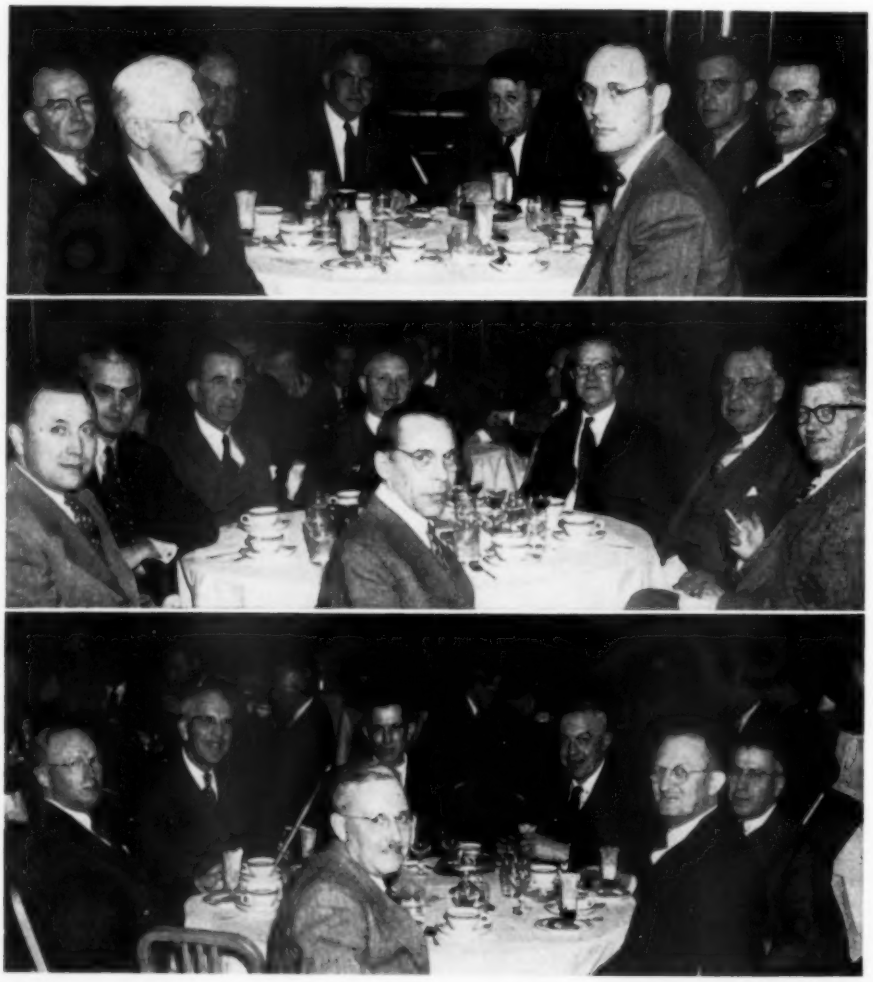
B. D. Claffey, Acme Aluminum Alloys Inc., Dayton, O., spoke extemporaneously on "Youth Encouragement." He stressed the importance of cleaner foundries and said that improvements must prevail to attract youth.

He advised foundrymen to invite school classes to view foundries in action; to assume the responsibility of inviting young men into the foundry industry and to portray for them the romance, thrill of accomplishment, leadership and opportunities that the foundry industry has to offer.

At the April meeting held in Hotel Freeport, Freeport, Ill., E. C. Hoenicke, Eaton Mfg. Co., Detroit, discussed permanent mold casting machines and the products to which they are adapted.

Mr. Hoenicke related that the original development of the permanent mold process was carried on with manually-operated, lever-type, single head machines. Subsequent improvements resulted in the perfecting of a cam-operated turntable, and finally the 12-head, semiautomatic, air-operated machine with rotating molds and suction cooling, such as is used today. He described the construction and operation of this machine and the molds which are used on it.

In conclusion he stated that castings produced by the permanent mold process are uniform throughout the entire range of section and are free of porosity. The absence of porosity and segregation is attributed primarily to the rapid cooling characteristic of the process. By proper design of the molds it is possible to obtain controlled directional solidification.—*Carl L. Dahlquist, Greenlee Bros. & Co.*



LUNCHEON for foundry owners and managers was held by Central New York Chapter of the AFA, Apr. 9. Max Kuniansky, national AFA president, addressed the group on the purposes and accomplishments of the association

Central New York

NATIONAL Officers' Night was held Apr. 9 at Onondaga Hotel, Syracuse, N. Y., by Central New York Chapter of the AFA with 110 members and guests present.

Max Kuniansky, national AFA president, briefly outlined the work of the National organization in providing technical data for use in various sections of the industry.

Thomas Curry, metallurgist, Lynchburg Foundry Co., Lynchburg, Va., was the technical speaker, and his subject was "Chemically Bonded Sands." Mr. Curry described the work done at Lynchburg Foundry in the development of chemically bonded sand, explaining its advantages and disadvantages and some of the steps which had been taken to overcome the latter. He showed slides of castings made by the company, using this sand, and pointed out improvements in each that were attributed to chemically bonded sand.

In addition to the regular evening program, the chapter held a luncheon earlier in the day to which foundry owners and managers were invited. Mr. Kuniansky described the purposes and accomplishments of the AFA to the 45 men present.

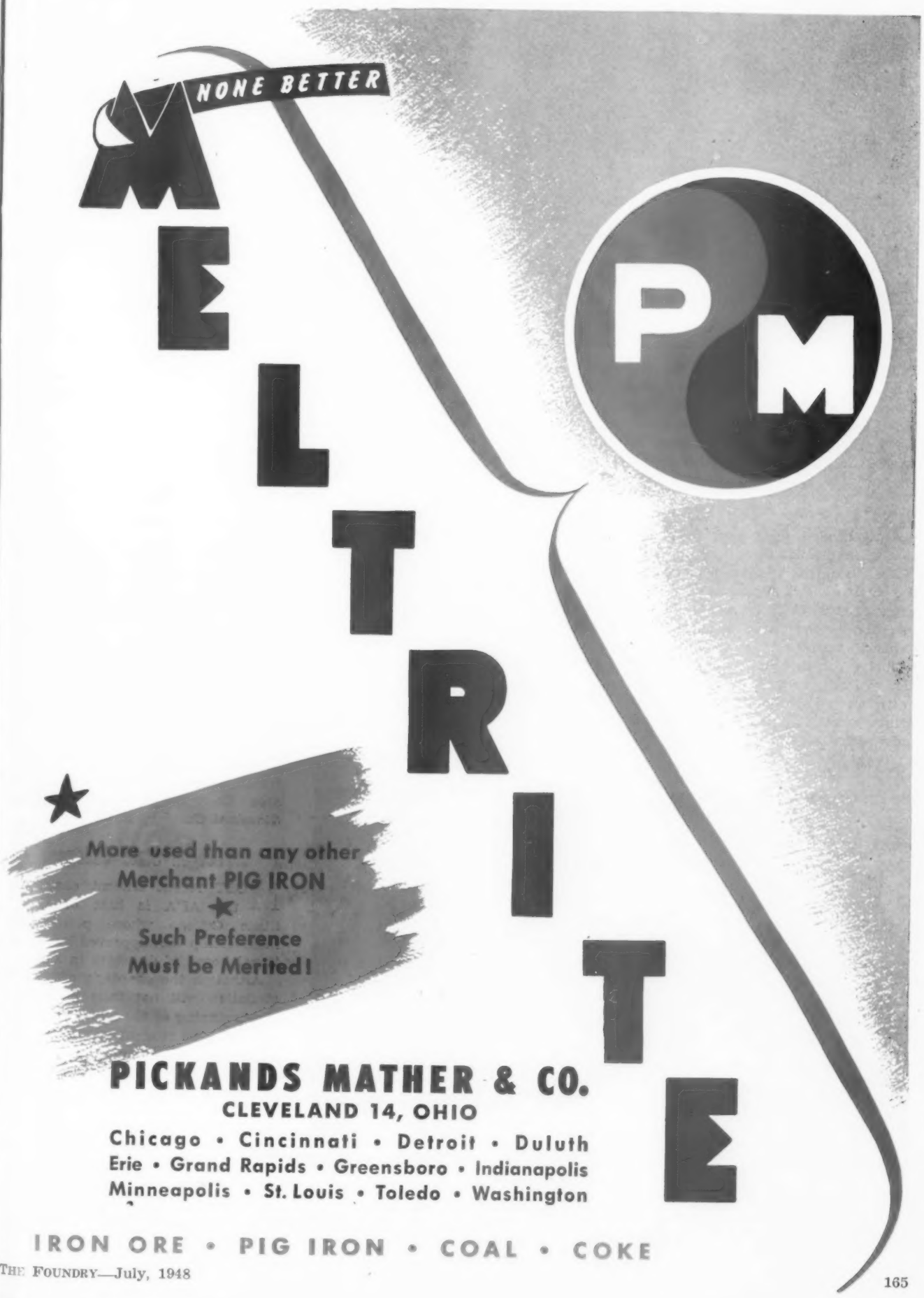
Norman Smith, Link-Belt Co., was the principal speaker at the dinner meeting of Central New York Chapter of the AFA held May 14 at the Onondaga Hotel, Syracuse, N. Y. Mr. Smith presented the subject, "Mechanization for Small Foundries," which was of considerable interest to the 100 members and guests present.

He opened his talk with the statement that if the foundry is to be "a good place to work," much of the heavy manual labor should be eliminated in order to attract the young men of today.

Many operators of small foundries do not think of mechanization because of the belief that large sums of money are involved, but, according to the speaker, installations have been made, even in foundries employing as few as six molders, that are economical both to install and operate.

Mr. Smith proved his statements with a series of slide pictures that showed more efficient operations with much less heavy labor in foundries that were either partially or fully mechanized and employed from six

(*Continued on page* 166)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Merchant PIG IRON
Such Preference
Must be Merited!
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Erie • Grand Rapids • Greensboro • Indianapolis
Minneapolis • St. Louis • Toledo • Washington
IRON ORE • PIG IRON • COAL • COKE

CENTRAL ILLINOIS Chapter of the AFA met at Jefferson Hotel, Peoria, Ill., Apr. 5, to celebrate National Officers' Night. Shown in informal discussion at the meeting are, left to right, F. W. Shipley, Caterpillar Tractor Co., Peoria, Ill.; L. L. Clark, Buick Motor Division, General Motors Corp., Flint, Mich., speaker at the meeting; W. B. Wallis, national AFA vice president; J. E. Kolb, Caterpillar Tractor Co., and national AFA director, and A. V. Martens, Pekin Foundry & Mfg. Co., Pekin, Ill., chapter chairman

(Continued from page 164)
to sixteen molders.

The technical session was under the direction of James Ochsner, Crouse-Hinds Co., Syracuse. Before introducing the main speaker, Mr. Ochsner introduced a Dr. Ludwig Wilhelm Von Brimback, portrayed by Henry Bach, Crouse-Hinds Co., who gave an elaborate history of his achievements in German industry and universities.

The audience was impressed and listened attentively to the doctor's description of the regimentation of foundries and the methods used to overcome material shortage in Germany during World War II.

As Von Brimbach proceeded, those present realized he was burlesquing the foundry materials problem everyone is facing in this country today and the group settled back to enjoy the act. Mr. Bach's impersonation was complete and everyone was surprised when his real identity was revealed at the end of his talk.—*John A. Feola, Crouse-Hinds Co.*

OLD TIMER: Among those honored by Northeastern Ohio Chapter, AFA, at its recent Old Timers Night was Gus Zimmerman (right), Eberhard Mfg. Co., Cleveland, who has spent 67 years in the foundry industry. He is shown with L. N. Schuman, plant superintendent, National Malleable & Steel Castings Co.

Milwaukee Non-Ferrous

NEW chapter of the Non-Ferrous Founders' Society was formed by nonferrous foundrymen of the Milwaukee district on May 24. Officers elected for the coming year are: L. J. Andres, Lawran Foundry Co., Milwaukee, president; H. O. Blackstone, Waukesha Foundry Co., Waukesha, Wis., vice president; J. A. Arter, Ampco Metals Inc., Milwaukee, secretary; and L. B. Pfost, Kenosha Brass & Aluminum Foundry, Kenosha, Wis., and John R. Dwyer, Badger Brass & Aluminum Foundry Co., Milwaukee, directors-at-large.

In addition to organizing the chapter, members heard G. R. Colburn, vice president, American Appraisal Co., speak on "Fire Insurance Coverage Hazards." A program of management problems, including costs, is scheduled for future meetings.

Ontario

ONTARIO Chapter of the AFA met at Toronto May 14 to mark the closing of the current season. Retiring Chairman James Dalby, Wilson Brass & Aluminum Foundries, Toronto, presided, and turned the meeting over to R. A. Woods, Geo. F. Pettinos Co., Hamilton, the incoming chairman who announced the other newly elected officers.

J. A. King, Werner G. Smith Co., Toronto, incoming vice chairman and retiring entertainment committee chairman, introduced a group of entertainers who provided an enjoyable floor show.—*Alvin E. Bock, Standard Castings & Mfg. Co.*

Oregon State College

MOST recent student chapter of the AFA is that of Oregon State College whose petition for membership was approved by the national board of directors in April.

Although the chapter's official installation will not take place until the beginning of the new school term this fall, the student group has been authorized to operate as a full-fledged chapter.

Chapter officers, elected early in March are: Ted Sullivan Jr., chairman; John F. Oettinger, vice chairman; John P. Meece, secretary and Everett M. Uebel, treasurer.

The chapter has selected W. B. Kirby, engineer, Electric Steel Foundry Co., Portland, Oreg., as its

(Continued on page 168)

METALLURGICALLY SPEAKING
KEOKUK'S THE "STUFF"

Chief Keokuk makes a fusion in a silicon determination — an important laboratory function in the manufacture of Keokuk Electro-Silvery.

STEEL PLANTS—60-pound Keokuk Electro-Silvery Pigs for blocking the open hearth heat. For equal distribution of silicon and best temperature melt-down. Handle by magnet. FOUNDRIES—30-pound Keokuk Electro-Silvery Pigs for charging mechanically or by hand into the cupola. Easily broken into two or more pieces, handled by magnet and measured by weight. Regular or alloy analysis. FOUNDRIES—12½-pound Keokuk Electro-Silvery Piglets so uniform in weight that they may be charged into the cupola by count, eliminating weighing operations. Handle by magnet. Regular or alloy analysis.

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(*Continued from page* 166)
industrial advisor. Mr. Kirby was guest speaker at the chapter's first meeting, Apr. 29, at Corvallis Hotel, Corvallis, Oreg. He spoke on "The Need of College Men in the Foundry."

Southern California

APRIL meeting of Southern California Chapter of the AFA was held at the Rodger Young Auditorium. Speakers of the evening were R. D. Sangster, industrial materials division, Los Angeles Chamber of Commerce and Kenneth L. Clark, technical representative, International Nickel Co.

Mr. Sandster listed some reasons why the West is not getting enough merchant iron. Material for his talk was a series of letters written and letters received from various steel executives. His conclusions, based on this summary, are: Coke and scrap are in short supply and will remain so. While some coke is finding its way to the West coast from western sources, most of it is going east. High priced and inferior scrap is the rule, not the exception. Many poor castings owe their flaws to badly sorted and below par scrap. The West is the steel industry's "orphan."

As to the outlook for improvement: Letters from western suppliers indicate "consciousness of this shortage on the coast," but make no definite commitments as to possible betterment.

SOUTHERN CALIFORNIA: Views of the Southern California Chapter of the AFA April meeting are shown here. At upper right, left to right, are: R. D. Sangster, Industrial Materials Division, Los Angeles Chamber of Commerce, coffee speaker; Henry E. Russill, Eld Metal Co. Ltd., Los Angeles, chapter chairman, and Kenneth L. Clark, technical representative, International Nickel Co., technical speaker

Mr. Clark spoke on "Variables in Foundry Practice." In the related fields of melting, molding and heat-treating, variables are best met by close reasoning based on accurate knowledge. He advocated analysis of the physical form of scrap and accurate record keeping of lot melting. He said that coke size should be 10 per cent of cupola diameter.

With respect to sand, bonding materials, fluxing action of impurities, moisture content and other variables must be known and recognized. In conclusion he said that pouring temperature and pouring speed are influenced to some extent by gating and risering arrangement, and this arrangement should be governed by the idea that castings freeze from the outside in.

Nomination of new officers includes Leonard Hofstetter, West Coast Foundry Equipment Co. Los Angeles, president; Earle D. Shomaker, Kay-Brunner Steel Products Inc., Alhambra, Calif., vice president; John E. Wilson, secretary, and Henry Howell, treasurer. Directors nominated are: Dan Eggleston, James Dewald, Robert Colson and John Durkin.—*Maurice Beam.*

Pittsburgh

PRINCIPLES of quality control was the theme of the last meeting of the 1947-48 season held by Pittsburgh Foundrymen's Association May 17 at Fort Pitt Hotel, Pittsburgh.

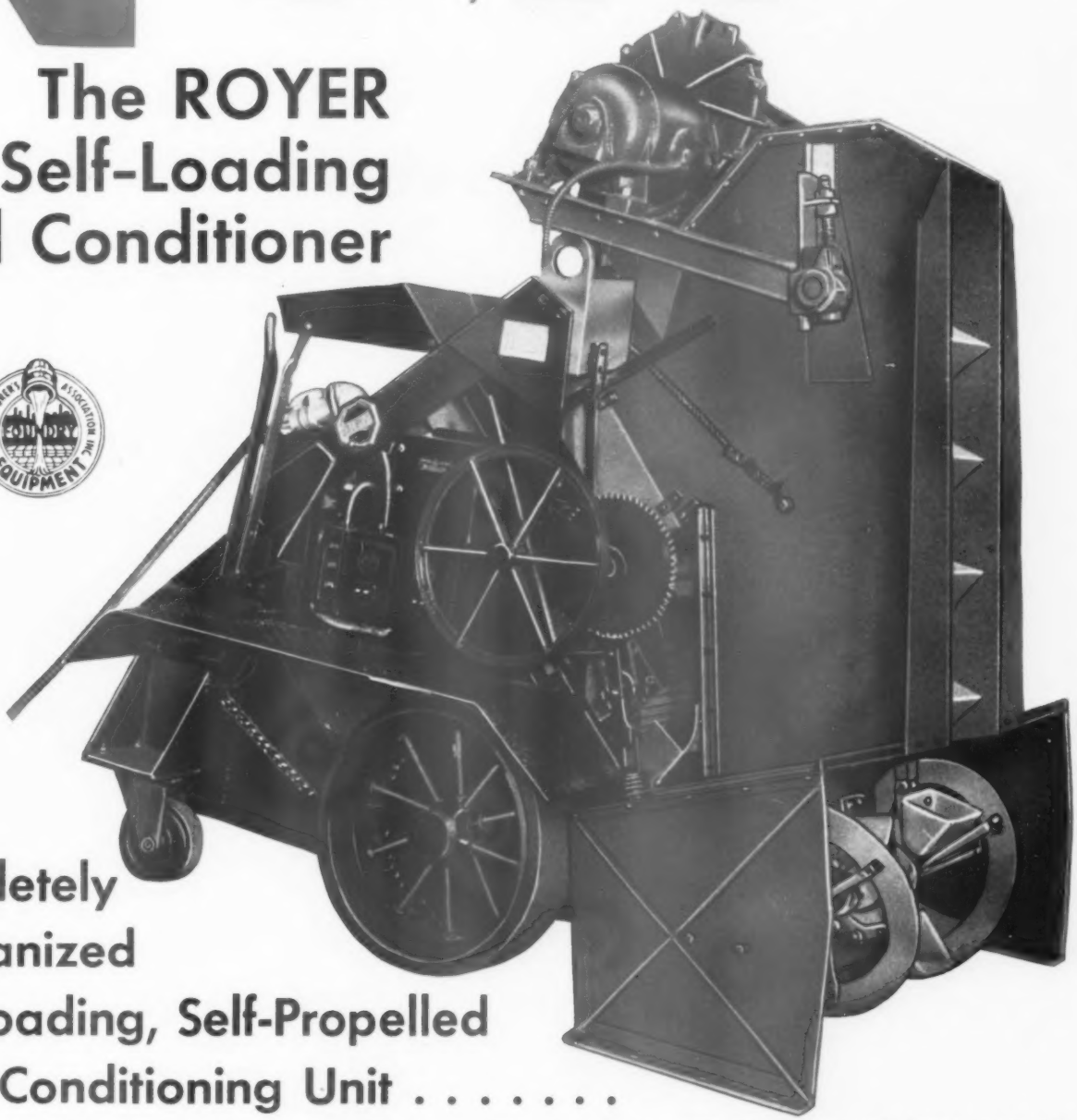
In discussing this subject, J. Manuele, director of quality control, Westinghouse Electric Corp., stated that inspection is a post-mortem operation; it does not improve product quality and does not add to the value of the product. Rejections at inspection mean scrap or repair—added cost. Rejections also mean failure to obtain maximum production from available equipment and personnel. Quality control, he said, maintains product quality at any desired level. Quality control properly administered will achieve the following results: Improved quality, maximum production from available equipment and personnel, decreased unit cost; and improved operators' morale.

Statistical records for controlling quality are effective in analyzing factors responsible for the production of substandard quality products. However, statistical methods require the collection of some data and the keeping of some records. These data and records generally will furnish the answer to such questions as: Are we doing the best we can? What is causing the production of defectives?

(*Continued on page* 170)

New

The ROYER Self-Loading Sand Conditioner



A Completely Mechanized Self-Loading, Self-Propelled Sand Conditioning Unit . . . . . .

No more hand labor. One man at the variable speed controls handles your whole sand preparation job . . . scoops up sand while moving into the heap . . . culls out all trash . . . combs, blends, aerates, improves permeability . . . and discharges up to 50 tons per hour of high grade molding sand. *Imagine what this new Self-Loading Royer will do for YOUR foundry production!*

Let us send you full details about this revolutionary new Self-Loading Sand Conditioner. Write for detailed information.

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FOREMOST IN SAND CONDITIONING EQUIPMENT

ROYER FOUNDRY & MACHINE CO.

159 PRINGLE ST., KINGSTON, PA.

NEW OFFICERS of Pittsburgh Foundrymen's Association for the 1948-49 season were elected at the May 17 meeting. They are, left to right: John A. Meyer, National Alloy Steel Division, Blaw-Knox Co., vice president; Carroll B. Dick, Westinghouse Electric Corp., president; and E. P. Buchanan, Pittsburgh Coke & Chemical Co., secretary-treasurer

(Continued from page 168)

Statistical methods have been used for process control in machining and assembly operations. More recently they have been applied to foundry operations with most satisfactory results.

Chemical composition of gray iron, machinability of castings, and the dimensions of castings can be controlled by the application of statistical quality control principles. The quality control tools best suited for this purpose are the frequency distribution curve and various charts. The skilled statistician, however, will find use in the foundry applications for such tools as: Analysis of variances; correlation; and tests for significance.

The cost of administering a properly organized quality control department normally is nominal, compared to results obtained. Such cost should not exceed more than 2 or 3 per cent of the productive payroll.

Officers of the association for the 1948-49 season also were elected at the May 17 meeting. They are: president, Carroll B. Dick, Westinghouse Electric Corp.; vice president, John A. Meyer, National Alloy Steel Division of Blaw-Knox Co. and secretary-treasurer, E. P. Buchanan, Pittsburgh Coke & Chemical Co.—*Joseph C. Sullivan.*

PUBLIC SPEAKING class sponsored by Detroit Chapter of the American Foundrymen's Association was the first one ever sponsored by a local foundry group for foundrymen in general. Class Instructor Allen Harwood, Dearborn Motors Corp., is shown handing Lee Nelsen, assistant foundry superintendent, Michigan Steel Casting Co., the nightly award of a can of oil for presenting the most effective speech of the evening

Northwestern Pennsylvania

FINAL meeting of Northwestern Pennsylvania Chapter of the AFA for the year 1947-48 was held May 24 at the Moose Club, Erie, Pa., with about 100 members and guests present. Frank G. Steinebach, editor, THE FOUNDRY, spoke on "Recent Developments of the Foundry Industry."

Mr. Steinebach told of the importance of the industry during the recent war and the confusion that prevailed among the various agencies in Washington because they were not acquainted with the different kinds of metals needed for various equipment required by the armed forces. He also stated that due to the coordination of the various organizations representing the metals industries and the recognition being given them by the government agencies today, much of the confusion would be eliminated in case of another emergency.

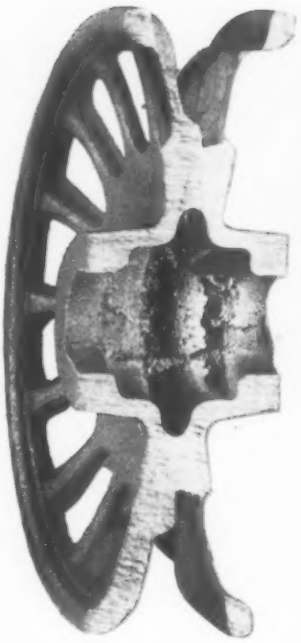
He went on to say that since the war the foundry industry has made great strides both in improving its product and in installing modern equipment; the latter has made the foundry a better place in which to work and also has increased production considerably with less manual effort. The surface has only been scratched, however, and new and better ideas and methods are coming to the front daily. He gave a bird's-eye view of the present shortage of materials used in the production of castings and what is being done to replace scarce commodities.

Much credit was given the AFA for its leadership in promulgating not only technical information of great importance but also its educational programs.

Newly elected chapter officers for 1948-49 are: Joseph J. Hornstein, Meadville Malleable Iron Co., Meadville, Pa., chairman; Joseph Shuffstall, National-Erie Corp., Erie, vice chairman; R. J. Harding, Pickands Mather & Co., Erie, secretary, and Frank Volgstadt, Griswold Mfg. Corp., Erie, treasurer.

The following four retiring officers who had served the chapter since its organization were honored by Chairman John Clarke, General Electric Co., Erie: Earl Strick, past chair-

(Continued on page 172)



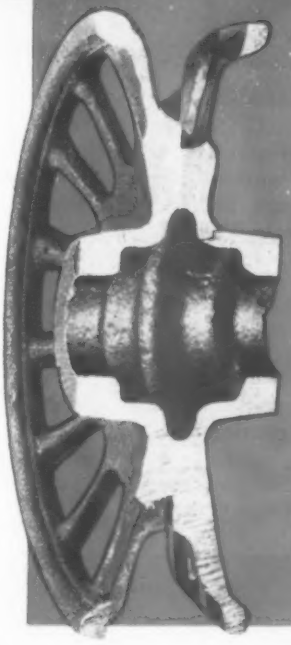
Bronze Casting *Above* Made With Untreated Core

At Right Same Casting Made With KORGLAZE Treated Core

Use KORGLAZE for the "Problem Child" that has bothered you or is sure to bother you tomorrow . . . For Finer Castings Use KORGLAZE

KORGLAZE

For *Completely Smooth* CORES



1. *For Processing Cores To a Smooth Surface . . .* KORGLAZE can be sprayed, dipped or swabbed. Drys out quickly. Leaves graphite or talc tightly bonded to the core.

2. *For Preventing Metal Penetration . . .* KORGLAZE presents a core surface practically impenetrable to molten metal . . . gives a finer finish, a casting of truer dimension. Thus, KORGLAZE saves excess metal and eases off on machining.

3. *For Protecting a Fine Line of Cleavage Between Core and Casting . . .* KORGLAZE facilitates speed of shake-out and assures clean-cut castings of even the most intricate design.

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NORTHWESTERN PENNSYLVANIA Chapter of the AFA met at Erie, Pa., May 24. Newly elected officers are shown here with Frank G. Steinebach, editor, *The Foundry*, who addressed the meeting. Left to right are: R. J. Harding, Pickands Mather & Co., Erie, secretary; J. S. Hornstein, Meadville Malleable Iron Co., Meadville, Pa., chairman; Mr. Steinebach; Joseph Shuffstall, National Erie Corp., Erie, vice chairman; F. P. Volgstadt, Griswold Mfg. Co., Erie, treasurer. Photo courtesy of *Erie-Dispatch*

(*Continued from page* 170)
man and vice chairman and director; Fred Eisert, director; Tom Beaulac, director, and Harry Gebhardt, secretary. Special tribute was paid Past Chairman Strick, co-organizer of the chapter, who has not missed a meeting since the chapter was organized, and Mr. Gebhardt, past secretary, for his untiring chapter activities.

The entire membership saluted Mr. Clarke, retiring chairman, for a successful year as presiding officer, and he thanked everyone for the co-operation afforded him during his tenure of office.

James J. Farina, entertainment chairman, introduced the Moose Quartet who presented a fine musical program, and also announced that the chapter picnic would be held in Tieman's Grove, Erie, Sept. 11.—*Earl M. Strick, Erie Malleable Iron Co.*

Eastern New York

EASTERN New York Chapter of the AFA held its regular monthly meeting Apr. 20 at Circle Inn, Albany, N. Y. William Wallis, national AFA president, was a guest of the chapter and gave a short talk.

Main speaker of the evening was W. B. George, R. Lavin & Sons, Chicago, who spoke on "Nonferrous Foundry Practice." It was an interesting talk followed by a lengthy discussion period.

The chapter met at Circle Inn again on May 18 with approximately 100 members and guests present. Technical topic was "Patterns for High Production," presented by Vaughan C. Reid, vice president, City Pattern Foundry & Machine Co., Detroit.

Mr. Reid explored the different problems in connection with the pat-

(*Continued on page* 174)

TRI-STATE: Views of Tri-State Chapter of the AFA National Officers' Night and the officers and directors meeting held Apr. 14 at Tulsa, Okla. Speakers' table at the dinner meeting is shown at upper left. Left to right are: Dale Hall, Oklahoma Steel Castings Co., Tulsa; Max Kuniansky, national AFA president; R. W. Trimble, Bethlehem Supply Co., Tulsa, chapter chairman; Fred E. Fogg, Acme Foundry & Machine Co., Coffeyville, Kans.; Frank R. Westwood, Service Foundry Co., Wichita, Kans., and Ben P. Glover, M. A. Bell Co., Tulsa. Chapter officers and directors are seen in session with Mr. Kuniansky in view at upper right

Dust-Sucker

FOUNDRY VENTILATING HOODS

Unsurpassed for Cleaning Up Foundry Air

● Bartlett-Snow Dust-Sucker Foundry Ventilating Hoods prevent dust, smoke and fumes from contaminating the foundry air. They avoid shutdowns and make foundries more desirable places in which to work—reducing absenteeism, and increasing production.

Due to the unique and patented* construction Dust-Sucker Hoods do not pick up the fines in the shaken-out sand, but only the dust suspended in the air. Consequently, Dust-Sucker Hoods subject the fans, ducts and other parts of the equipment to a minimum of abrasive wear, reducing upkeep and repair, and frequently permitting the dust, smoke and fumes to be exhausted to the outside atmosphere without using a dust collector at all.

Furnished in side wall and enclosing types. Wide range of standard sizes,—also as overhead canopies and in other special designs. Let us work with you on your requirements!

*U. S. Patent 121,704

10 advantages

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Dust-Sucker

FOUNDRY VENTILATING HOODS

1. Inexpensive to Operate.
2. No Adjustment Required.
3. No Manual Supervision.
4. Highly Efficient.
5. Minimum Maintenance.
6. Uniform Suction Across the Unit.
7. Low Air Velocity.
8. Picks Up Only Floating Dust.
9. Foundry Proved Design.
10. Sturdy, Serviceable Construction.

Write today for Bulletin No. 99. It gives full details.

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Extended-Shaft Fan—Type CE

MOTOR LOCATION OUTSIDE AIRSTREAM MEANS LONGER LIFE...GREATER ACCESSIBILITY

Propellair extended-shaft fans provide the *extra features* necessary for successful handling of corrosive or abrasive high-temperature gases. Location of motor completely outside airstream gives *maximum* protection and *convenient* accessibility. Motor inspection and maintenance require no duct dismantling—no disruption of service.

Propellair extended-shaft fans give excellent circulation of air within drying ovens—fan operates within the oven, motor mounts outside.

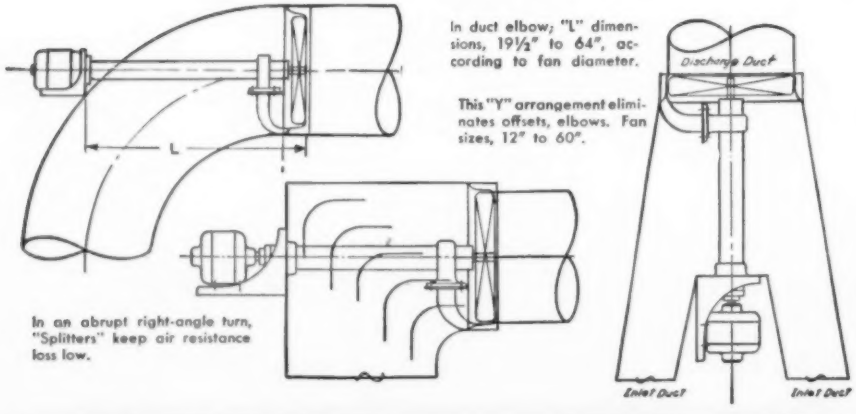
PROPELLAIRS FOR EFFICIENCY

Use airfoil-design Propellairs for *real efficiency* in air movement. Blades actually *pull* more air than they *push—spread* work evenly over their entire surfaces, for high-velocity, high-volume, axial-flow output.

HEAVY-DUTY FANS FOR FOUNDRIES

Compact, functional-design Propellairs for foundry use have proved their dependability and economy under operating conditions of every kind. Types and sizes for every service—for mounting in ducts or stacks, in walls or windows, or upon floor stands, pedestals, or roofs. Write today for full information.

TYPICAL DUCT INSTALLATIONS


L
In duct elbow; "L" dimensions, 19½" to 64", according to fan diameter.
This "Y" arrangement eliminates offsets, elbows. Fan sizes, 12" to 60".
Discharge Duct
In an abrupt right-angle turn, "Splitters" keep air resistance loss low.
Inlet Duct
Inlet Duct

PROPELLAIR
DIVISION OF ROBBINS & MYERS • INC.
SPRINGFIELD • OHIO

(*Continued from page* 172)

ternmaking phase of the foundry industry. With the aid of lantern slides he brought out the problems confronting the pattern shop and foundry. He concluded his talk with the following poem:

The designer leaned across his board,
Wonderful things in his head were stored,
And he said as he scratched his throbbing bean,
"How can I make this thing hard to machine.

"If this part here were only straight
I know the thing would work first rate;
But it would be so easy to turn and bore,
It would never make the machine hands sore.

"So I think I'll put a right angle there
And watch those babies tear their hair;
And for the holes that hold the cap,
I'll place them where they're hard to tap.

"The thing won't work I'll bet a buck,
For it can't be held with plate or chuck;
It can't be drilled, it can't be ground,
In fact the design is exceedingly sound."

He looked again and said at last,
"Success is mine; it can't even be cast."

The following slate of officers were nominated for 1948-49: A. C. Andrew, American Locomotive Co., chairman; K. Echard, Eddy Valve Co., vice chairman, and U. Navarette, General Electric Co., secretary-treasurer.

Directors for three years are: P. Wilson, Hunter Machine Co.; R. Garrison, Adirondack Steel Co. and R. DeVarrenes, Rensselaer Valve Co. Directors for two years: L. Nelson, Ludlow Valve Co.; J. Wheeler, Wheeler Brass Co. and L. Scully, Scully Brass Co. Directors for one year: Scott MacKay, Rensselaer Polytechnic Institute; Ted Carlson, General Electric Co. and K. Mason, Albany Casting Co.—*D. B. Slater, General Electric Co.*

Texas

ON Apr. 16 Texas Chapter of the AFA met in Lufkin for a one-day conference which included national officers' meeting, plant visitations, management luncheon and a dinner meeting. Meeting was attended by 225 foundry men and guests.

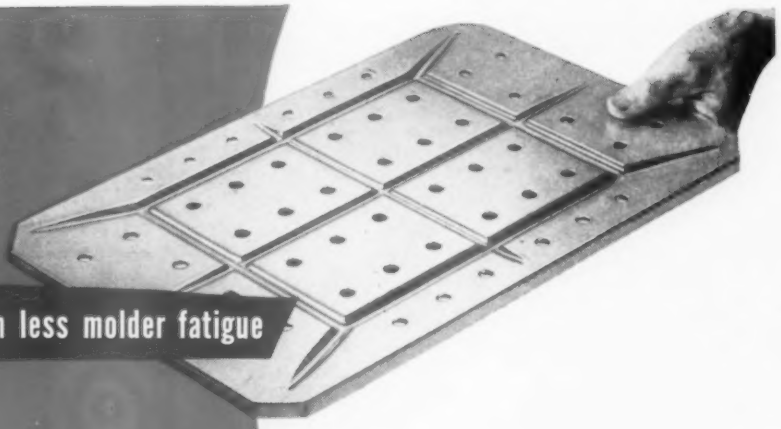
Jack Klein, vice president, Texas Foundries Inc., Lufkin, was chairman of arrangements and worked in co-operation with Marvin Williams, Hughes Tool Co., Houston, chapter chairman, for the day's activities.

Texas Foundries Inc. and Lufkin Foundry & Machine Co. were hosts to a management luncheon at which Col. Cal C. Chambers, president and general manager, Texas Foundries Inc., introduced the speaker, Anthony Haswell, president, Foundry Educational Foundation. Mr. Haswell described the progress of the foundation and explained how foundrymen

(*Continued on page* 176)

SO LIGHT

... you obtain more production with less molder fatigue



SO DURABLE

... they can be considered permanent equipment ...

THE SENSATIONAL NEW

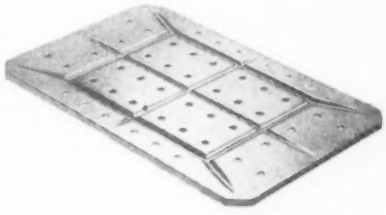
Edco Dowmetal

BOTTOM BOARDS

"Revolutionary . . . incredible . . . extremely economical!" These are comments from the field as EDCO DOWMETAL Bottom Boards are finding greater and greater acceptance in progressive foundries.

Revolutionary . . . in the many advantages *feather-light magnesium* offers over anything previously known in bottom boards. Incredible . . . in their greater resistance to heat. Economical . . . in their long-lasting durability under usual foundry conditions.

Made of magnesium, these boards will not warp or break. There are no nails to come out, nothing to break or split—no upkeep! You'll find that they will save you money because they give better mechanical results and no other metal or wood boards can compare with them in utility and length of life.



When used as a combination squeezer and bottom board, EDCO DOWMETAL magnesium boards give firm, equal distribution of pressure, eliminating mold "shifts", "breaks" or "cracks". They maintain high quality of castings and reduce rejects because the special grooved and vented design permits escape of gasses and insures mold stability.

Write for complete details and prices covering the wide range of standard sizes.

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SO VERSATILE

. . . because Schramm can furnish air for any compressed air job in your work; and versatile because there is a size and model Schramm to fit your individual needs! Just specify the size you need.

SO EASY TO OPERATE

. . . merely by pushing a button to start, and compact and lightweight enabling you to move the portable units wherever you like! Meanwhile, the stationary units take up very little room, are vibrationless and no trouble!

SO ECONOMICAL

. . . because Schramm can do *all* your compressed air jobs quickly and efficiently. Features that assure economy include 100% water cooled, forced feed lubrication, and mechanical intake valve.

it pays to use Schramm!

Your field has found that Schramm Air Compressors well fit its needs. And has specified Schramm everywhere . . . North, East, South and West. Write today for full data.

TOOLS FOR THE JOB

Schramm Inc. also has a complete line of Pneumatic Tools to offer and recommend for operation by their Compressors.

These include Rock Drills, Paving Breakers, Trench Diggers, Clay Spades, Backfill Tampers, Tie Tampers, Sheeting Drivers, Demolition Tools, Chain and Circular Saws.

Write for bulletins and prices.

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

(*Continued from page* 174)

from the Southwest could and should participate in the program.

Prof. B. B. Begemen, head of mechanical engineering department, Texas University, Austin, and Prof. Charles Crawford, head of mechanical engineering department, Texas A & M, College Station, were guests at the luncheon.

At 4 p.m. Max Kuniansky, national AFA president, met with the Texas Chapter directors and discussed chapter activities in the national program.

The technical meeting was held at 5:15 p.m. at the Texas Foundries' canteen. James H. Smith, general manager, Central Foundry Division, General Motors Corp., Saginaw, Mich., talked on "Progress with Motion Study." He pointed out that most any job could be improved with little expense by the proper motion analysis. Mr. Smith was assisted in his talk and demonstrations by S. D. Martin, production manager, Central Foundry Division, General Motors Corp., Danville, Ill. Their talk was illustrated by a motion picture which showed a number of jobs in the Saginaw plant before and after motion analysis.

The group then moved to the Angelina Hotel ballroom for the dinner meeting. Mr. Kuniansky spoke on "American Foundrymen's Association Activities." He said that the AFA had made great progress in the last few years and the future is much brighter. He also remarked that proper selection of chapter committeemen was imperative for continued AFA progress.—*Malcom J. Henley.*

Chesapeake

CLYDE FREAR, Bureau of Ships, Washington, addressed the April meeting of Chesapeake Chapter of the AFA on the subject, "Bronze Pressure Castings."

The speaker explained that the chief cause of leakage is interdendritic shrinkage, recognized by the presence of distinct dendrites in the fractured surface. This type of shrinkage may be prevented by keeping the riser open to atmosphere pressure through use of a gypsum insulating riser sleeve, exothermic riser compounds, or induction heating of the riser. He added that low pouring temperatures minimize dendrite growth and thereby aid casting soundness.

Factors recommended by Mr. Frear for improving the quality of bronze castings are: Using gas-free materials, melting in a slightly oxidizing atmosphere, avoiding overheating,

preheating ladles, pouring at low temperatures, and designing for directional solidification and complete feeding.—*Jack H. Schaum, National Bureau of Standards.*

Cincinnati

OVER 200 members and guests of Cincinnati District Chapter of the AFA heard Lester B. Knight, Lester B. Knight & Associates Inc., Chicago, speak on "Modernization of Small Foundries" Apr. 12 at Suttmillers Restaurant, Dayton, O.

In his opening remarks, Mr. Knight stated that mechanization of a foundry was not the complete answer to making quality castings at a profit. The volume of business must be such that the investment can be amortized over the shortest possible period of time, without having to increase the price of castings.

LESTER B. KNIGHT

Factors listed by Mr. Knight which should be considered before any modernization is attempted are:

Check on housekeeping to see that equipment is arranged in orderly fashion so that no time is lost by workmen in procuring the necessary equipment.

Arrangement of foundry facilities should be such that the work flows in a straight line and raw materials and finished products are handled as few times as possible.

Jobs should be analyzed in a critical manner to determine whether it is possible to rig pattern or corebox equipment in a different way or change flask sizes to increase efficiency of molding and coremaking operations, thereby decreasing costs.

A good wage incentive plan should be considered, as some very remarkable results can be obtained from its

(*Continued on page* 180)

Foundry work moves faster with

2 SPEED METEOR ELECTRIC HOISTS

Capacities from ½ to 3 tons

To meet demands for greater production and higher efficiency, many progressive foundries are replacing obsolete, undependable handling equipment with new heavy duty, two-speed Meteors. Designed specifically for foundry work, the Meteor provides slow speed for careful starting of loads... and high speed for fast lifting when the load is free. The Meteor is fully enclosed, weather-proofed and protected against dust and dirt. Airplane-type cooling fins quickly dissipate heat generated by gears and load brake. Low headroom, precision construction, motor thermal protection, only 110 volts in push button station, helical gears, are other quality features. If you want extra value for your investment, write today for literature and prices.

WRITE *for Bulletin 142... contains 22 pages of specifications, illustrations and prices.*

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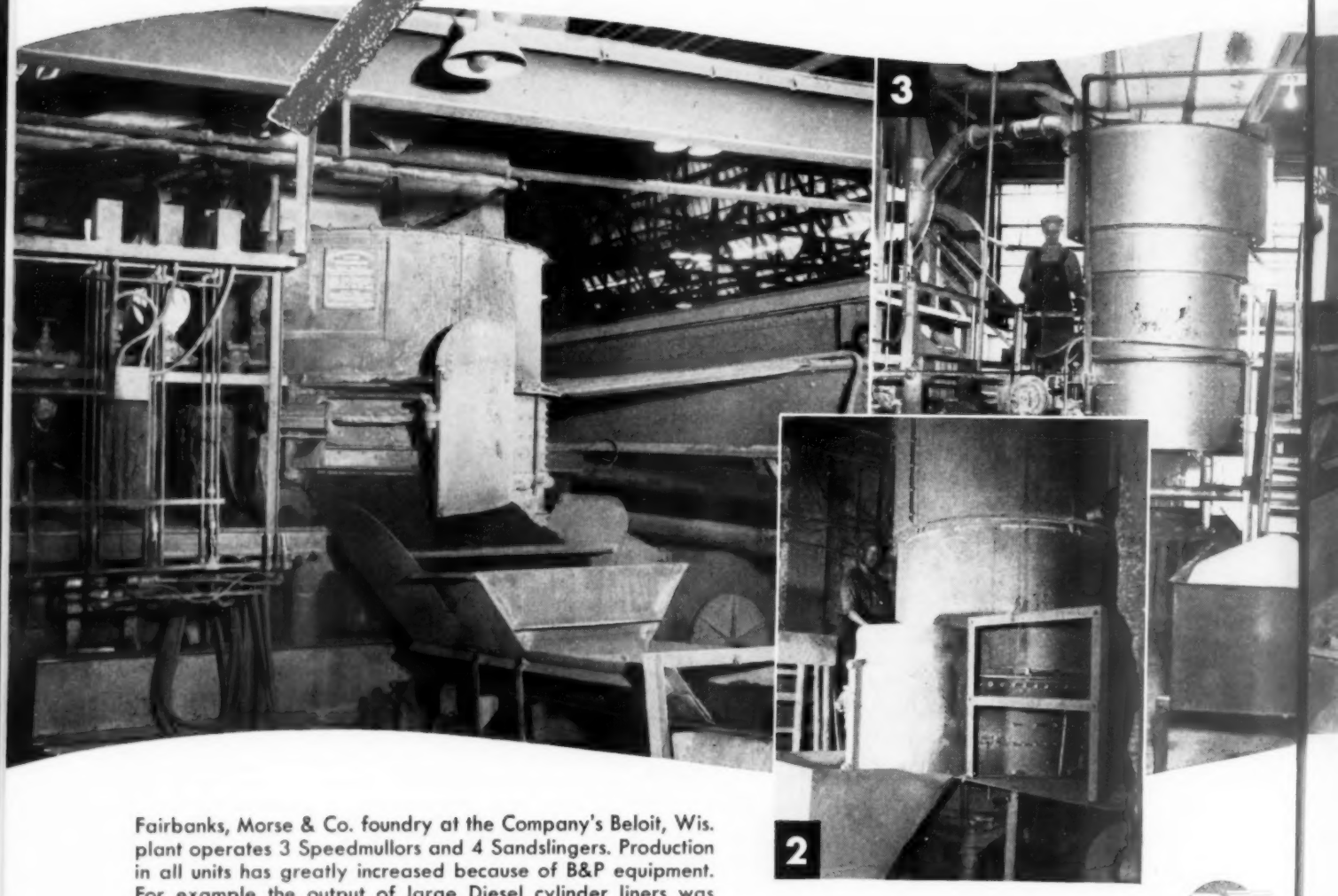
GENERAL OFFICES AND FACTORIES: TONAWANDA, N. Y.

SALES OFFICES: New York • Chicago • Cleveland • San Francisco • Los Angeles

3 SPEEDMULLORS 4 SANDSLINGERS



Fairbanks, Morse & Co. foundry at the Company's Beloit, Wis. plant operates 3 Speedmullors and 4 Sandslingers. Production in all units has greatly increased because of B&P equipment. For example the output of large Diesel cylinder liners was stepped up from 13 to 66 per day by the installation of a Stationary Sandslinger and auxiliary equipment. Two Motive Jr. Sandslingers and a Locomotive Sandslinger ram medium size and large floor molds in a fraction of the time required by hand shoveling and air ramming. The 3 Speedmullors produce a total of 470 tons of sand per day—320 tons for the mechanized production unit, 100 tons for miscellaneous work, and 50 tons for the non-ferrous foundry. The B&P equipment at the Beloit Foundry and at the Company's several other foundries enables Fairbanks-Morse to maintain economical and profitable production.

A description of foundry operations at the Fairbanks, Morse & Co. Beloit Works appeared in the November, 1947, issue of BETTER METHODS. Write for it.

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Division of Pettibone Mulliken Corporation

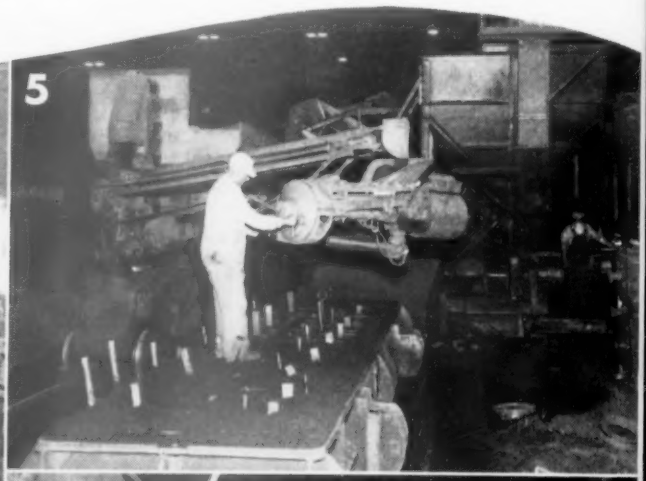
General Offices: 2424 North Cicero Avenue **Plant:** 2541 North Keeler Avenue

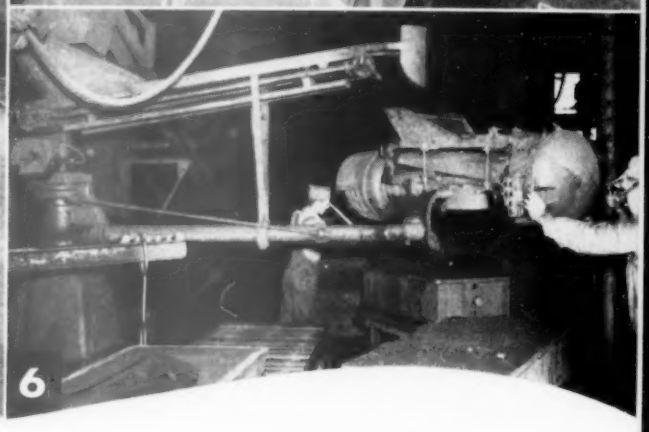
Chicago 39, Illinois

Beardsley & Piper are manufacturers of the Sandslinger • Speedslinger • Hydra-Slinger • Speedmullor • Mulbaro • Screenarator • Junior Nite-Gang • Preparator • Champion Speed-Draw • Plate Feeders • Turntables • Gyratory Screens

TOP LEVEL PRODUCTION FOR

FAIRBANKS-MORSE FOUNDRY





1 No. 80 Speedmullor serving the production molding unit at Fairbanks-Morse. With a batch capacity of 20 cu. ft., it thoroughly cools and mulls sand in 1½ minute cycles . . . over 320 tons per day.

2 No. 50 Speedmullor (batch capacity 7½ cu. ft.) serves the miscellaneous molding floors. Here again the feature of combination cooling and mulling during a 1½ minute cycle per batch is of utmost importance. This Speedmullor mulls and cools 100 tons per day.

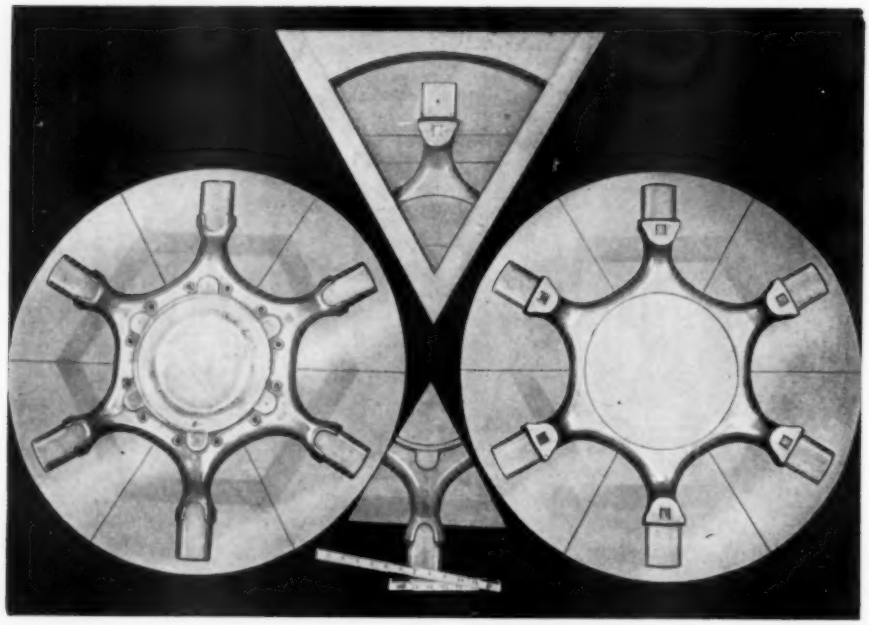
3 No. 40 Speedmullor in the non-ferrous foundry has a batch capacity of 5 cu. ft. It mulls 3 types of sand averaging 50 tons per day.

4 A Motive Jr. Sandslinger quickly rams a long row of Diesel engine cylinder molds. Another Motive Jr. has been recently installed in another bay to ram large Diesel engine crankshaft molds.

5 In use since 1937, the Locomotive Sandslinger rams the largest molds in the foundry's heavy molding bay. Here, the Sandslinger is ramming the cope of a base for an eight cylinder 14" x 17" Diesel engine.

6 This Stationary Sandslinger helped increase production of Diesel cylinder liners more than 500%.

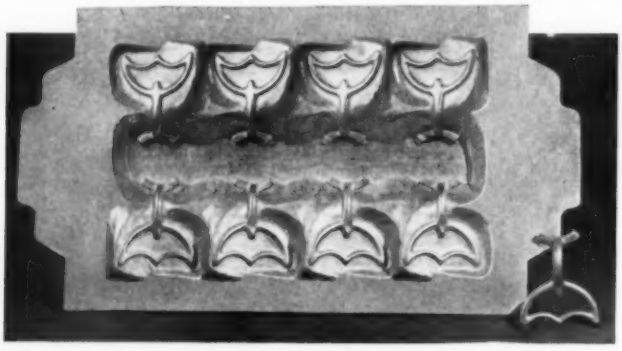
PROFIT BY OUR MANY YEARS OF EXPERIENCE



Cope and drag equipment for truck wheel, made from one spoke (1/6) of wheel

Get More Production and Cut Costs!
Use Pressure Cast Matchplates and Cope and Drag Plates

Only one master pattern does it! From it we make you single or multiple pattern matchplates, casting them under pressure in plaster molds. Why not find out exactly how much we can save you by this method, or by furnishing cope and drag plates which likewise jump production and lower your costs? Write us for quotations now.



Matchplate made from master pattern

PLASTER PROCESS CASTINGS COMPANY
6922 Carnegie Avenue **Cleveland 3, Ohio**
Affiliate—Toledo Matchplate Co., 534 State St., Toledo 2, Ohio

Pressure-Cast MATCHPLATES
COPE and DRAG PLATES

(*Continued from page* 177)

use.

A good educational program for supervisory personnel is necessary so that they will be able to take advantage of the facilities which are at hand.

After all the above factors have been taken care of it is time to consider if it will be profitable for the plant or any phase of the operation to be mechanized.—*C. H. Fredricks, Cincinnati Milling Machine Co.*

Chicago

NEW officers and directors of the Chicago Chapter, AFA for the 1948-49 year were elected and installed at the monthly meeting of the chapter, May 18, at the Chicago Bar Association.

Chester K. Faunt, works manager, Christensen & Olsen Foundry Co., Chicago, who during the past year has served as vice president and chairman of the program committee, is the new president. New vice president is W. D. McMillan, works metallurgist, McCormick Works, International Harvester Co., Chicago, and secretary to succeed himself is Victor M. Rowell, sales technician, Velsicol Corp., Chicago. The office of treasurer, occupied last year by Bruce L. Simpson, president National Engineering Co., Chicago, is appointive by the board of directors.

Taking office as new directors are A. W. Gregg, executive engineer, Equipment Division, Whiting Corp., Harvey, Ill.; Martin Rintz, foundry superintendent, Continental Foundry & Machine Co., East Chicago, Ind.; Roy Frazier, foundry consultant, Love Bros. Inc., Aurora, Ill.; and Retiring President Fred B. Skeates, foundry superintendent, Link-Belt Co., Chicago.

After assuming the chair, President-elect Faunt presented the chapter's "Oscar," the Past President's Statuette, to Retiring President Skeates, as appreciation of his services during the past year.

Four roundtable sessions, covering steel, gray iron, malleable and patterns, constituted the technical portion of the meeting.

The Steel Division roundtable featured Charles Locke, metals research department, Armour Research Foundation of Illinois Institute of Technology, Chicago, as speaker, on the subject "Heat Treatment of Steel Castings." Richard E. Kerr, metallurgist, Pettibone Mulliken Corp., Chicago, presided.

A. F. Grindle, vice president, Whiting Corp., Harvey, Ill., and Ray A. Witschey, ceramic engineer, A. P. Green Fire Brick Co., Chicago, ad-

dressed the Malleable Division roundtable, their subject being "A New Quick Anneal Batch Oven for Malleable." Chairman of this session was W. D. McMillan, works metallurgist, McCormick Works, International Harvester Co., Chicago.

The Nonferrous and Pattern Divisions jointly sponsored a roundtable at which H. K. Swanson, owner, Swanson Pattern & Model Works, East Chicago, Ind., and Martin G. Dietl, metallurgist, Crane Co., Chicago, discussed "Patterns for the Nonferrous Foundry."

"Sand Distribution in a Foundry" was the topic for the Gray Iron Division roundtable at which William Wyatt, sales director, Pekay Machine & Engineering Co., Chicago, was the speaker. Eugene W. Smith, Western Materials Co., Chicago, presided.

Mr. Wyatt's description of a sand handling system which includes little storage capacity but which provides adequate supply of conditioned sand at the instant it is needed, proved of considerable interest to his audience. In this system, the sand passes from the muller, is aerated and cooled and delivered to an overhead belt conveyor which passes over the molding stations. The hopper at each station is set to store enough sand for only 1½ molds, a volume too small to cause packing.

The hopper is equipped with a full-opening gate which the molder actuates by pushbutton to deliver a pre-set amount of sand for one mold. Simultaneous with opening of the gate a plow-type screw mounted over the conveyor belt goes into action to remove from the belt and replace in the hopper the amount of sand just discharged from it. High-speed action of the screw fluffs the sand further. Sand not removed from the belt at any of the molding stations drops off at the end to an under-floor belt to be returned to the muller and thus repeat the travel cycle.—*Erle F. Ross.*

Twin City

CARLETON C. Hitchcock, partner, R. C. Hitchcock & Sons, Minneapolis, has been elected chairman of Twin City Chapter of the AFA for 1948-49, and Franklin P. Austin, vice president, Crown Iron Works Co., Minneapolis, vice president. Both have served as chapter directors; Mr. Hitchcock since 1946, Mr. Austin for the last year.

Lillian K. Polzin, director of the manufacturers' secretariat, Minneapolis Chamber of Commerce, was re-elected chapter secretary-treasurer. Retiring chapter chairman, Sheldon P. Pufahl, president, Pufahl

a new night gang for your foundry

JUNIOR
NITE-GANG

Here it is . . . A complete portable molding sand preparation unit! The Junior Nite-Gang provides magnetic separation, screening, aeration, and the elimination of hand shoveling . . . *all in one machine.*

The Junior Nite-Gang is the only really portable machine for the small foundry which eliminates tedious hand shoveling and provides magnetic separation, thorough screening and aeration of molding sand.

SEND COUPON FOR NEW BULLETIN!

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☐ Where may I see Nite-Gang in operation?
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DINGS
High Intensity
LIFTING MAGNETS

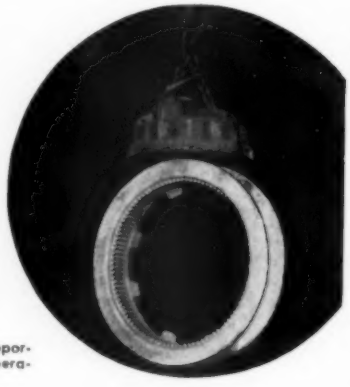
HARD-TO-HANDLE MATERIALS ARE NO PROBLEM WITH THESE MAGNETS

Just a touch of the electric controller . . . and the toughest material handling jobs are easily expedited. *Powerful* Dings Lifting Magnets handle steel plates, bars, castings, rods, tubing, wire and all other forms of magnetic material rapidly . . . easily . . . economically . . . with big labor savings. No straps, slings or hooks needed. Built in diameters from 8 to 65 inches . . . to carry loads from 50 to 65,000 lbs. Write for catalog No. 220 which gives complete data.

They Stay Stronger . . . Longer

Some of the reasons why:

- **Shock absorbing construction**—Coils kept in place despite abuse. Ribbed design used for tough service.
- **Water and weather-proofing**—Coils are vacuum-impregnated and sealed in watertight casing.
- **Long trouble-free life**—Engineered and built for toughest service.
- **Balanced magnetic circuit**—Copper wire and steel proportioned to give maximum lifting capacity with lowest temperature rise.



An eight-foot diameter casting just out of the foundry flask is swung away and stacked easily with a Dings Lifting Magnet.

DINGS MAGNETIC SEPARATOR COMPANY
4708 West McGeogh Avenue • Milwaukee 14, Wisconsin

"HIGH INTENSITY" **Dings**

Separation Headquarters Since 1899

Foundry Inc., was named to a one-year term as director.

Directors elected to serve three years are Joseph W. Costello, pattern shop foreman, American Hoist & Derrick Co., St. Paul; Carl W. Olson, Jr., foundry manager, C. W. Olson Mfg. Co., Minneapolis, and C. Fred Quest, assistant manager, J. F. Quest Foundry Co., Minneapolis.

Named to complete the unexpired terms of Mr. Hitchcock and Mr. Austin as directors, one and two years, respectively, are S. L. Cameron, Jr., vice president, Valley Iron Works Inc., St. Paul, and Charles Kausel, secretary-treasurer, Kausel Foundry Co., Minneapolis.

Central Ohio

OVER 120 members and guests of Central Ohio Chapter of the AFA met at the Chittenden Hotel, Columbus, O., May 24 for the final meeting of the season. The application of motion study to foundry operations was discussed by S. D. Martin and S. W. Healy, Central Foundry Division, General Motors Corp. The speakers enlivened their presentation by actual demonstrations of coremaking and light molding operations which could be greatly speeded up while at the same time reducing operator fatigue.

A major point emphasized by the speakers was that appreciable increases in production can be obtained by quite small investments in equipment. Scientific study of operations permits the specification of balanced motion paths, shorter motion paths, elimination of tiring body bending, and uninterrupted rhythm. Coupled with simple devices and proper arrangements of the work place, these principles are responsible for the greater output at reduced operator fatigue.

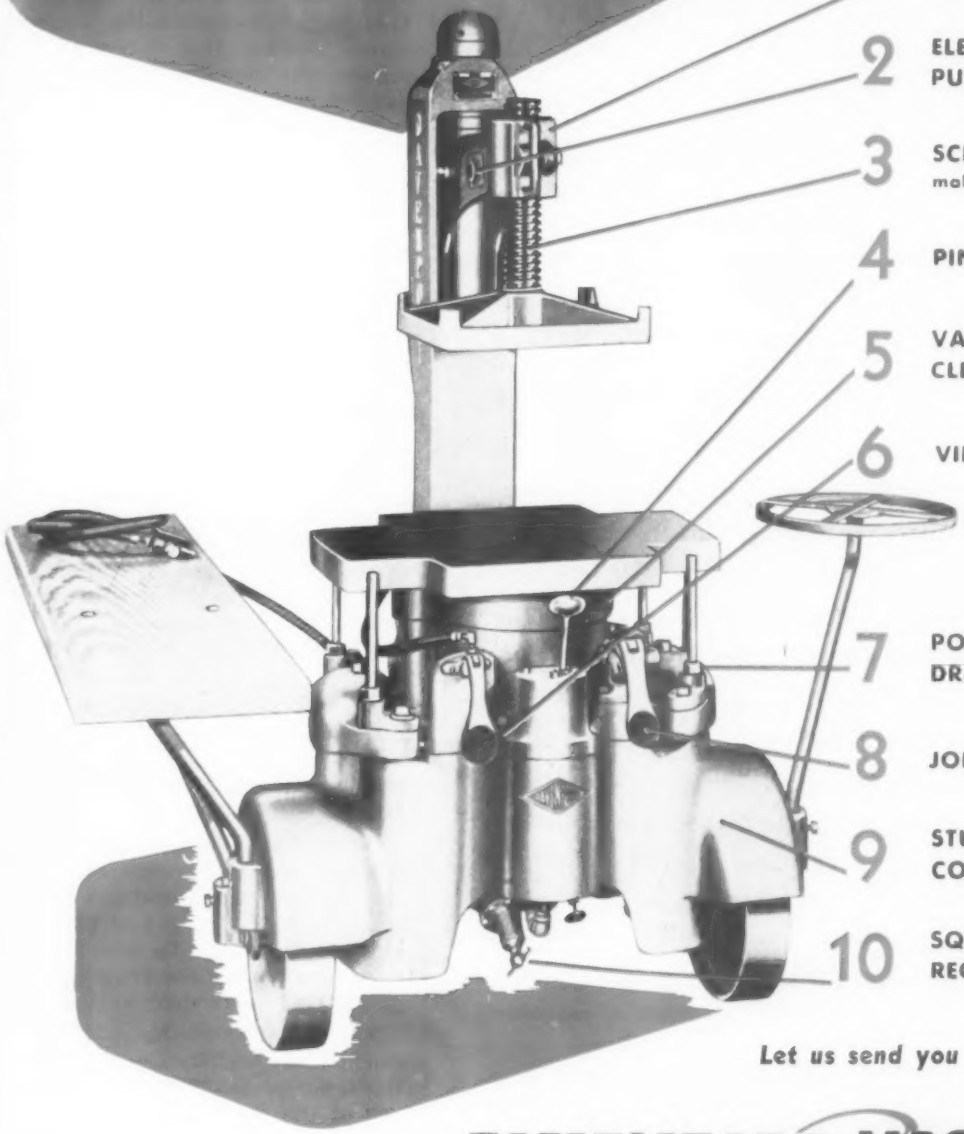
Another major point in favor of scientifically arranged working sequences is that such balanced operations permit a given operation to be done by a wider range of labor, and make it easier to obtain steady workers on the job.

To illustrate the application of these principles in practice in a production foundry, an excellent motion picture showing "before" and "after" operations at the Saginaw plant of Central Foundry Division was shown.

The coffee program for the evening consisted of a sound motion picture in color. Prepared for the Aluminum Co. of America, "Unfinished Rainbows" was an interesting history of the commercial development of alu-

(*Continued on page* 184)

Almost everybody AT THE PHILADELPHIA SHOW LIKED THE NEW Davenport Jolt Squeeze Pin Lift



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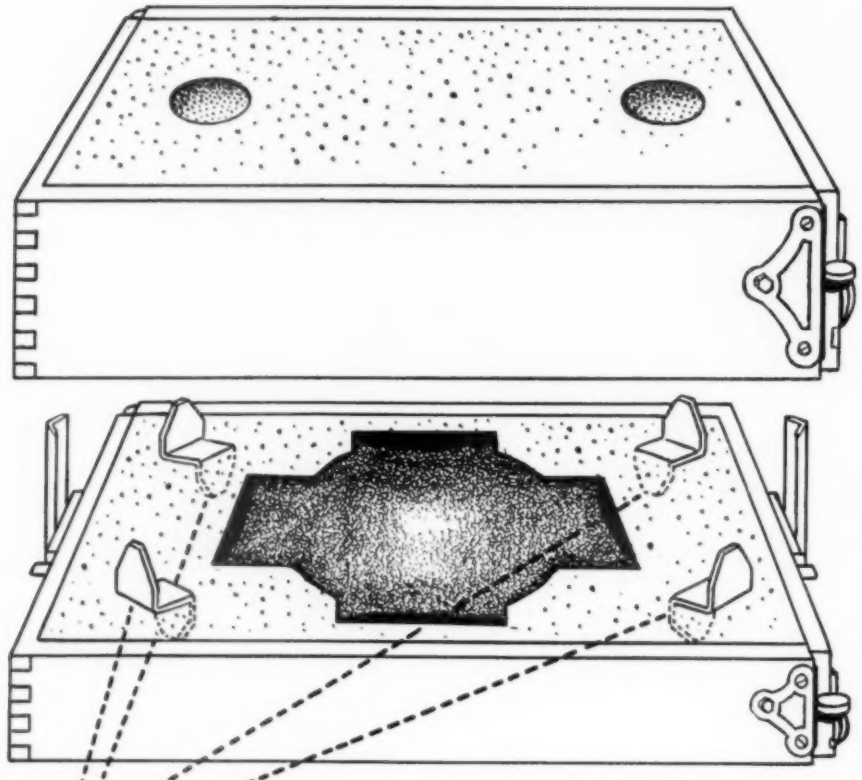

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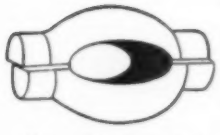
Foundrymen who have given MILWAUKEE Mold Anchors a practical trial on snap-flask and slip-flask molds have found that they cut costs . . . earn extra profits in 2 ways: —

1 **They prevent shifts between cope and drag . . . resulting in higher production and lower scrap casting losses.**

2 **They eliminate the need for *expensive offset pattern* plates.**



Shifts make Scrap Castings . . . even a slight shift between cope and drag causes enough misalignment between upper and lower halves of casting to make scrap of it.

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(*Continued from page* 182)

minum.

Ray Frank, Bonney-Floyd Co., retiring chapter chairman, announced election of the following officers for 1948-49: Fred Fuller, National Engineering Co., chairman; Walter Deutsch, Columbus Malleable Iron Co. vice chairman; Dan Krause, Gray Iron Research Institute, secretary, and W. T. Bland, Commercial Steel Casting Co., treasurer.

The chapter plans its annual outing for Aug. 21.—*H. W. Lownie Jr., Battelle Memorial Institute.*

Cleveland Non-Ferrous

CLEVELAND Chapter of the Non-Ferrous Founders' Association resumed its regular monthly meetings May 27 at Hotel Cleveland, following completion of the cost clinic the chapter conducted the previous several months. It is planned to hold regular meetings the fourth Thursday of each month in the future, except during July and August.

Chapter Chairman David B. Kennedy, Gluntz Brass & Aluminum Foundry Co., presided at the May meeting. Business session of the program consisted of informal discussion of various problems affecting operations of district nonferrous foundries. William A. Gluntz, president of the national association, reported on the last meeting of the board of directors at Philadelphia, and pointed to further steady growth in association membership and activities.

New Jersey

MAJOR steps in the development of a practical foundry modernization program were outlined by William G. Reichert, president, W. G. Reichert Engineering Co., Newark, N. J., before approximately 80 members and guests of the New Jersey Foundrymen's Association at the Military Park Hotel, Newark, Apr. 19.

He emphasized the importance of first making a thorough survey of the various departments, with respect to flow, the type of materials required and costs. He also stressed close appraisal of the company's organization and employee personnel.

The speaker said that often much can be accomplished in enhancing the financial position of a company and at the same time improving its product by such fundamental studies and without heavy expenditures for new equipment. Not infrequently only minor mechanical changes are necessary, adding that partial mech-

(*Continued on page* 186)

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WE *mean the top-speed, high-production, don't-let-me-down spot!* That calls for a Tabor Yoke-Type Jar Squeezer—the same one you saw at the Tabor booth and in operation with National Engineering Company equipment at the "Philly" Show.

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3. Wear on squeeze cylinder is so reduced that it won't be necessary, within the conceivable life of the machine, to re-bore or replace this part.
4. It's now impossible, under any circumstances, for the squeeze piston to blow out—a vital safety factor.
5. Entire squeezing or jarring unit may be quickly detached from the machine for easy inspection.

You'll agree there's something good here for you. The machines are in stock. We invite your inquiry.

Diam. Squeeze Cylinder	Table Size	Space Between Uprights
10″	18″ x 20″	32″
13″	18″ x 24″	36″

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Howell Works: Howell, Mich.

(*Continued from page* 184)

anization with plenty of flexibility is the best solution in various cases.

Mr. Reichert said that so many foundries have already improved their operations so extensively that when real competition returns it is going to be difficult for the old style foundry to obtain its share of the business. He again warned that study of basic practices and policies, including cost and proper personnel training and organization, is essential in laying the foundation for other possible major improvements, such as changes in plant layout and new labor-saving equipment.

William R. Shook, Worthington Pump & Machinery Corp., Harrison, N. J., discussed proposed changes in the income tax law as related to corporations with particular reference to the carry-back provisions which he regarded as being a special interest to heavy industry.

G. W. Hannay, Barnett Foundry & Machine Co., Irvington, N. J., announced that the association's annual outing would be held at the Crestmont Golf Club in the Orange mountains of northern New Jersey, the scene of last year's outing, Thursday, June 17. An all-day program, with a dinner and entertainment in the evening, is being arranged.

Substantial savings in operating costs can be achieved easily by the close attention to coreroom procedure, L. P. Robinson, Werner G. Smith Co., Cleveland, told members of the New Jersey Foundrymen's Association at their regular monthly dinner meeting May 17, at Military Park Hotel, Newark, N. J.

He discussed fundamentals of good coreroom practice, such as proper sand, binders, ratios, moisture content, venting, mixing, mulling time and baking time. He expressed the opinion that considerable money is lost every year in the average jobbing foundry due to guesswork in these factors.

Mr. Robinson stressed the importance of obtaining the right kind of sand for the job required, and in commenting on the use of cereal binders remarked that because a little is often a good thing the disposition of the average foundryman is to use too much and thus do more harm than good. He said that not more than 1 per cent cereal is adequate in the use of most sands and that often one-half that is sufficient. In good coreroom practice it is essential to start with dry sand and if necessary to install a small sand dryer.

He commented on the need for

(*Concluded on page* 188)

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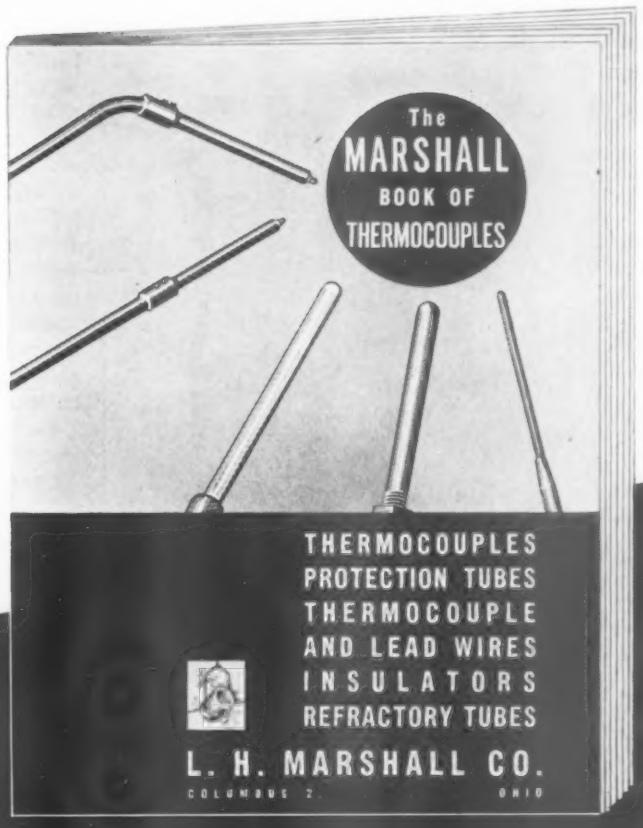

Every foundryman interested in controlling molten metal temperatures, and producing better brass and other non-ferrous castings, should have a copy of this new Marshall Catalog! This new book illustrates and describes Marshall Enclosed-Tip Thermocouples for both furnace and ladle use, including the convenient, factory-adjusted Replacement Units. Complete pyrometer units for stationary and portable service are also shown. Mail in the reply coupon for your free copy of this informative book. L. H. Marshall Co., 270 W. Lane Ave., Columbus 2, Ohio.

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Full information will be sent on request.

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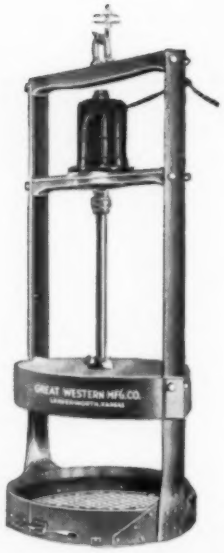

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LEAVENWORTH, KANSAS

(*Continued from page* 186)

baking cores slowly and remarked that even an old stationary oven could do a good job for the average jobbing shop, especially if equipped with new recirculators. He also urged that more attention be paid to the pyrometer and briefly discussed venting problems.

John L. Carter, secretary, commented on local conditions in the foundry trade. Pig iron and scrap are still scarce, although possibly less stringent than a while ago. However, the situation in coke appears as tight, if not tighter than ever.

Nonferrous foundrymen of the New Jersey area met at the Newark Athletic Club May 17 to discuss the present business situation, prospects, recent wage settlements as reported in various sections of the country and the increase in costs of castings in the last six months.

Later, they adjourned to the meeting of the New Jersey Foundrymen's Association.—*B. K. Price.*

Philadelphia

PHILADELPHIA Chapter of the AFA met at the Engineers' Club, Philadelphia, Apr. 9. Over 250 members and guests heard Norman Dunbeck, Eastern Clay Products Inc., Jackson, O., address the technical session.

Mr. Dunbeck's talk covered the subject of chemically coated sands. He told about the research that this sand entailed, its reactions, uses, mixes and benefits derived therefrom. He also explained the extreme care in its conditioning, its high initial cost as compared with other sands, and the amount of further research work still to be accomplished before this sand can be a "foolproof sand" used on any castings regardless of thickness or size.—*J. L. Furey, Swan-Finch Oil Corp.*

Boston Non-Ferrous

FOUNDRYMEN of the Boston Chapter of the Non-Ferrous Founders' Society Inc. met at the Engineer's Club May 27. "New Foundry Horizons," a motion picture released by the National Engineering Co., gave the group some new ideas on methods of handling and production.

Walter M. Clark, national director, reported on national society activities from the board of directors' meeting held in Philadelphia. H. W. Finch, Wollaston Brass & Aluminum Co., North Quincy, Mass., was elected chapter secretary to replace Benjamin Carlson of the same firm who died Apr. 4.

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TABLE I—Physical Properties of Manganese Bronze Tested Under Varying Conditions of Loading in Atmosphere and Sea Water

Specimen Number	Medium	Loading Method (Time)	Sea Water Immersion Days	Sea Water Immersion Load, psi	Tensile Strength psi	Yield Strength psi	% Elongation in 2"
BETA SPECIMENS FROM ROCKER ARM CASTINGS							
1	Atmosphere	At once	..	.....	85,750	39,750	16.5
2	Atmosphere	Prolonged	21	37,500			
	Atmosphere	Prolonged	14	40,000			
	Atmosphere	Prolonged	4	42,500	87,000	.....	25.0
3	Sea water	Prolonged	11	25,000			
	Sea water	Prolonged	7	32,500			
	Sea water	Prolonged	7	37,500			
	Sea water	Prolonged	4	45,000	(crack in fillet at water level)		
4	Sea water	Prolonged	12	37,500	(crack in gage length at water level)		
5	Atmosphere	Prolonged	6*	37,500			
	Sea water	Prolonged	6	37,500			
	Sea water	Prolonged	2	40,000			
	Atmosphere	At once	..	.....	85,000	.....	18.0
6	Sea water	Prolonged	7	25,000			
	Sea water	Prolonged	7	27,500			
	Sea water	Prolonged	7	30,000			
	Sea water	Prolonged	5	32,500			
	Sea water	Prolonged	5	35,000			
	Sea water	Prolonged	7	37,500			
	Sea water	Prolonged	2	40,000	(severely cracked)		2.0
7	Sea water	Prolonged	7	25,000			
	Sea water	Prolonged	7	27,500			
	Sea water	Prolonged	7	30,000			
	Sea water	Prolonged	7	32,000			
	Sea water	Prolonged	7	35,000			
	Sea water	Prolonged	10	37,500			
	Sea water	Prolonged	3	40,000	(small cracks)		1.0
BETA SPECIMENS FROM SPECIAL HEATS POURED IN SHIPYARD FOUNDRY							
8A	Atmosphere	At once	..	.....	85,750	38,000	18.5
8	Sea water	Prolonged	3	39,000	(cracked)		0
9	Sea water	Prolonged	6	39,000	(cracked)		2.0
10	Sea water	Prolonged	4	40,000	(fractured)		1.0
11	Sea water	Prolonged	12	40,000	(fractured)		4.0
BETA SPECIMENS FROM HEATS POURED BY FOUNDRIES UNDER CONTRACT TO SHIPYARD							
12A	Atmosphere	At once	..	.....	87,500	32,250	25.0
12	Sea water	Prolonged	7	32,500			
	Sea water	Prolonged	7	35,000			
	Sea water	Prolonged	1	37,500	(cracked)		3.5
13A	Atmosphere	At once	..	.....	87,100	38,000	22.0
13	Atmosphere	Prolonged	2*	35,000			
	Sea water	Prolonged	7	35,000			
	Sea water	Prolonged	7	37,500			
	Sea water	Prolonged	..	40,000	(fractured in 2 hrs.)		2.0
14A	Atmosphere	At once	..	.....	85,000	36,250	21.0
14	Atmosphere	Prolonged	7*	36,000			
	Sea water	Prolonged	..	36,000	(fractured overnight)		0
15A	Atmosphere	At once	..	.....	88,000	28,250	27.5
15	Atmosphere	Prolonged	3*	27,500			
	Atmosphere	Prolonged	1*	30,000			
	Sea water	Prolonged	..	30,000	(fractured overnight)		0
16A	Atmosphere	At once	..	.....	85,500	35,750	21.0
16	Sea water	Prolonged	10	35,000			
	Sea water	Prolonged	7	37,500	(small crack)		5.5
17A	Atmosphere	At once	..	.....	85,500	35,750	20.0
17	Atmosphere	Prolonged	5*	35,000			
	Sea water	Prolonged	7	35,000			
	Sea water	Prolonged	1	37,500	(fractured at water level)		1.5
18A	Atmosphere	At once	..	.....	85,000	37,000	20.5
18	Atmosphere	Prolonged	6*	32,500			
	Atmosphere	Prolonged	7*	35,000			
	Sea water	Prolonged	5	35,500			
	Sea water	Prolonged	8	37,500	(severely cracked)		1.5
19A	Atmosphere	At once	..	.....	88,500	28,750	29.0
19	Sea water	Prolonged	14	27,500			
	Sea water	Prolonged	14	28,000			
	Sea water	Prolonged	2	30,000	(fractured)		3.0
ALPHA BETA SPECIMENS FROM SPECIAL HEATS POURED IN SHIPYARD FOUNDRY							
20A	Atmosphere	At once	..	.....	68,750	28,000	28.0
21	Sea water	Prolonged	20	28,000			
	Sea water	Prolonged	20	29,000			
	Sea water	Prolonged	20	30,000			
	Sea water	Prolonged	20	32,500			
	Sea water	Prolonged	16	35,000	(slight cracks)		11.0
22	Sea water	Prolonged	20	28,000			
	Sea water	Prolonged	20	29,000			
	Sea water	Prolonged	20	30,000			
	Sea water	Prolonged	20	32,500			
	Sea water	Prolonged	16	35,000	(slight cracks)		8.0
23	Atmosphere	Prolonged	7	30,000			
	Sea water	Prolonged	10	32,500			
	Sea water	Prolonged	21	35,000			
	Sea water	Prolonged	28	37,500	(fractured)		6.5
24	Atmosphere	Prolonged	2	30,000			
	Sea water	Prolonged	4	30,000			
	Sea water	Prolonged	10	32,500			
	Sea water	Prolonged	12	35,000			
	Sea water	Prolonged	8	37,500			
	Sea water	Prolonged	8	39,000	(fractured)		8.0

* Under load in atmosphere.

TABLE II—Chemical Analyses of Test Specimens Used in Stress Corrosion Test

Specimen No.	Copper	Aluminum	Iron	Manganese	Zinc	Tin
1-7 (incl.)	56.61	1.91	1.16	1.70	38.62	
8-11 (incl.)	56.54	1.75	0.78	0.36	40.57	
12	56.12	0.90	1.07	0.48	41.43	
13	58.60	1.64	1.20	0.40	38.16	
14	56.14	1.54	1.20	0.68	40.44	
15	54.37	1.50	1.29	0.67	42.17	
16	57.31	1.16	1.00	0.44	40.09	
17	53.73	1.31	1.35	0.48	43.13	
18	57.80	1.66	1.24	0.39	38.91	
19	55.34	1.45	1.10	0.52	41.59	
20-24 (incl.)	58.53	0.79	0.73	0.09	39.86	trace
Required	55-60	0.50-1.50	0.4-2.0	1.5 max	Rem.	1.00 max

STRESS CORROSION OF MANGANESE BRONZE CASTINGS

(*Continued from page* 87)

no bronzes of the alpha beta compositions failed in service. It therefore may be concluded that manganese bronze of alpha beta microstructure is far less sensitive to stress corrosion, and can be used for applications in sea water which are prohibited to the beta type bronze.

It is considered that the reasons for the superior resistance of the alpha beta bronzes to stress corrosion in sea water may be related to one or more facts brought out by this test. First, attention is called to the failure of the alpha beta bronze and the complete beta bronze with respect to the location of the cracks. It was shown in the alpha beta specimens (Fig. 15) that the cracks penetrated the grains along crystallographic planes, while the cracks in the beta specimens were intercrystalline, as shown in Fig. 10. It appears probable that there is less anodic material along these crystallographic planes and that they are less favorably oriented to permit the penetration of the sea water.

Cracks Follow Weak Structure

In the relationship of cracking to selective corrosion, it is possible that the cracks follow that part of the structure which is the weakest physically, and is the first to yield. If this is true, yielding occurs first along the slippage planes in the alpha beta bronze, whereas in the beta bronze the first metal to yield is confined to the grain boundaries; and since the corrosion is selective of those areas wherein plastic deformation is continually occurring, the cracks follow these highly stressed areas.

The second consideration is concerned with the ductility of the two types of bronze. Stress-strain curves which were plotted from the test of duplicate specimens indicated that the alpha beta bronzes commenced to yield at very low loads, showing a very low elastic range, wheras all beta bronze specimens showed elastic limits ranging between 17,500 and 27,500 psi. The plastic deformation occurring at low loadings in the alpha beta specimens may have accounted for a relaxation of the stress, thereby reducing it to some value below the critical "stress corrosion" load.

Although this consideration could not apply for specimens Nos. 23 and

(*Concluded on page* 192)

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The Abrasive Resistance of Various Metals **has had our careful study so that we can tell exactly what to expect when a core box is put into production. The accompanying table shows the relative resistance to abrasion of fifteen materials which have been tried in core box construction.**

BLAST RESISTANCE TEST RESULTS

Material No.	Efficiency
1	145%
2	135%
3	100%
4	76%
5	70%
6	63%
7	50%
8	50%
9	44%
10	42%
11	41%
12	35%
13	32%
14	20%
15	10%

If you aren't getting the core box life you think you should or if you are planning new core box equipment, we invite you to ask for our Advisory Service. We will welcome the opportunity to give you the benefit of the specialized experience and research which we have devoted to these problems.

New BULLETIN on Core Blowing

**We invite you to send for a copy of our new 8-page BULLETIN F, entitled, "Core Box Designing and Rigging for Core Blowing"—Harry Jacobson and Ed. W. Swiess.*

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(Concluded from page 190)

24, tested in the tensile machine where any relaxation was compensated for by the balancing of the beam, still it may have accounted for satisfactory use of the alpha beta bronze under actual service conditions where the loading may have differed from that as applied in the laboratory.

Conclusions — Manganese bronze castings conforming to Navy Department Specification 49B3f may be alloyed with a combination of elements to produce either an alpha beta or complete beta microstructure. Both types of bronze will fail by stress corrosion in sea water, but the alpha beta type is less sensitive to these conditions than the complete beta bronze.

The maximum average loads in excess of their yield strengths withstood by these alloys were 1594 psi for beta bronze and 8625 psi for alpha beta bronze.

The maximum average elongations obtained for alpha beta bronze and beta bronze tested under stress corrosion conditions were 8.4 per cent and 1.9 per cent respectively.

The average immersion periods to produce failure under stress corrosion conditons for these alloys were 4.31 days for beta bronzes and 83.25 days for alpha beta bronzes.

The failures of the beta bronze occur around grain boundaries, while the failures in the alpha beta bronze are transcrystalline.

Note: It has since been learned through current long-time immersion tests conducted in the laboratory that beta bronze, instead of failing under loads in excess of the yield strength, as reported above, fails at or slightly above the proportional limit. No failures have occurred in the alpha beta bronze specimens now under test, but present results indicate that the stress corrosion strength of this alloy is considerably above its proportional limit.

Editor's Note: This paper was presented in the *Journal of the American Society of Naval Engineers*, Vol. 58, No. 4, November, 1946.

List of Standards

American Standards Association, 70 Forty-fifth street, New York 17, just has published a list of all the national standards approved by the association. List includes standards for dimensions of machine tools and parts, rating and testing of electrical equipment, dimensions and identification of pipes and piping, building code requirements, industrial safety and health, occupational clothing, and definitions, abbreviations and symbols used in technical literature.

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Here are a few ways YOUR FOUNDRY can save time and money with

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Wheeling molding and facing sand to core-makers and molders. Just the right height to fit beneath the hopper of the muller, the Prime Mover walks away with heaping 1000-pound loads.

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With its platform body, the Prime Mover easily handles half-ton loads of bundled wire, heavy castings, gears, machine parts . . . a host of items that are best moved by small equipment.

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● Everywhere the BELL Prime Mover is used, workers and management alike are pleased with its performance. It takes the back-breaking labor out of "wheelbarrow" jobs... enables oldsters to continue to earn a full day's pay. Efficient, economical, a tireless worker, the Prime Mover helps keep plant labor costs at rock bottom. We'll be glad to give you more data on foundry applications obtained from scores of customers. Just mail the coupon.

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- bucket holds 10 cu. ft. . . . 18 with sideboards
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- half-ton platform body available; also 50-inch "baby bulldozer" blade
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- turns in its own length (63½"); width 31½"
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CASTING ALUMINUM MATCHPLATES IN PLASTER MOLDS

(*Continued from page* 78)

chine screw (in a hole previously tapped out for this purpose) in the center of the pattern, putting the frame around either the cope or drag plaster block, whichever one the pattern remains in, and with tongs or long pliers very carefully pulling the pattern straight out of the mold, using the edge of the frame as a fulcrum if necessary

Similarly, the other five pairs of plaster blocks are molded.

To cast these plaster blocks into the cope and drag cast iron frames shown in Fig. 4 it is desirable to have a work table upon which rests a piece of heavy plate glass (3/4-in. or heavier) which has an extremely flat surface and which is large enough to accommodate the cast iron frame. Lubricate the upper surface of the glass slightly using a cloth containing a few drops of any of the pattern lubricants (liquid only), then carefully place the cast iron frame on the glass plate.

It is necessary that all the drag blocks fit down flat on the parting surface. The six drag blocks just made do have a flat parting surface so that they may be placed parting side down directly on the glass plate as is described in detail in the next paragraph. However, in the event that the master pattern is of such contour that the parting surface of the resulting drag block is not a flat plane surface it is necessary to take an extra frame and pour it full of straight plaster of paris to make a follow board or match by cutting out recesses for the parts that lie below the surface of the plate.

After the cast iron frame has been placed on the glass plate, bevel off the edges of the six drag plaster blocks, as shown in Fig. 7, to allow the plaster to knit together all the blocks which make up the drag frame. Before placing in position as indicated in Fig. 7, it is necessary to soak all six blocks in water before pouring wet plaster into the frame. When soaking plaster molds take care that the faces do not actually come in contact with the water, and soak until most of the air seems removed from the molds.

Set the six drag blocks, parting side down, on the glass plate, allowing from 1/32 to 1/16-in. clearance between the blocks and spaced as shown with reference to the cast iron frame. After setting weights on each of the six blocks the drag frame is ready to pour. The weights can be removed after the plaster is partially set and then the frame can be struck off level in the usual manner.

After the plaster has set, the frame and cast-in blocks are removed from the glass plate and turned parting side up. This flat parting is lubricated with green plaster lubricant so as to slightly overlap the blocks. Set the cope blocks face down on their respective drag blocks, making sure that they fit down snugly. (The edges of the six cope blocks are first beveled off and the blocks soaked in water as was done for the six drag blocks). Put weights on top of cope blocks. Place cope cast iron frame on top of drag frame so that the outlines of the two frames coincide and slip loose pins down through corresponding pin holes in both frames. Also place an aluminum (turned) plug (2-in. diam. by 2 in. long) at a location corresponding to the center of the 4½-in. radius shown in Fig. 4. Set a weight on top of this plug, which is the pattern for the down sprue in the cope mold.

Molds Ready for Oven

Pour plaster in this (cope) frame and strike off as before. After plaster in cope mold has set lift it off, keeping pins in, and set both frames face up on a suitable work table. Trim off plaster male dowel projections and fill in female dowel depressions. The latter operation is done by roughing out the hole with a suitable tool and pouring water into the hole until fairly well soaked, then pouring plaster into holes, allowing to set and smoothing off level with the parting surface. Molds are now ready for oven.

Next it is necessary to mold a pouring basin. This is done by pouring plaster into a lubricated aluminum pattern. After the mold is struck off and allowed to set, it is carefully removed from the pattern.

Set both frames and the pouring basin in oven and bake out at 350° F until dry. This time will be dependent on the thickness of the mold, the type of oven used, and the positioning of the molds in the oven. We have found that in using a direct-fired gas oven of the noncirculating type 16 hours at 350° F for a 2-in. frame gives good results.

After the molds are dry the frames are again set out face up. All loose dirt particles are removed by blowing with air or by brushing lightly with a camel's hair brush. Although no chills are needed for this plate, this is the proper time for setting chills in cavities in the mold corresponding to heavy sections of the pattern. Fig.5 shows the type of chill used and an example several such chills placed in a mold containing large cavities. The pins of these chills (when used) are simply pushed into the dried mold material, allowing approximately 3/8-in. clearance for

(*Continued on page* 196)

PAST PRESIDENTS—Most of Wisconsin Chapter's past presidents assembled for this view taken at the AFA convention in Philadelphia. Left to right: William Bornfleth, Cutler-Hammer Mfg. Co.; W. J. MacNeill, G. H. F. Foundry Division, Dayton Malleable Iron Co., Dayton, O.; B. D. Claffey, Acme Aluminum Alloys Inc., Dayton, O.; G. K. Dreher, Foundry Educational Foundation, Cleveland; H. E. Ladwig, Allis-Chalmers Mfg. Co.; John Bing, A. P. Green Fire Brick Co.; R. J. Anderson, Belle City Malleable Iron Co.

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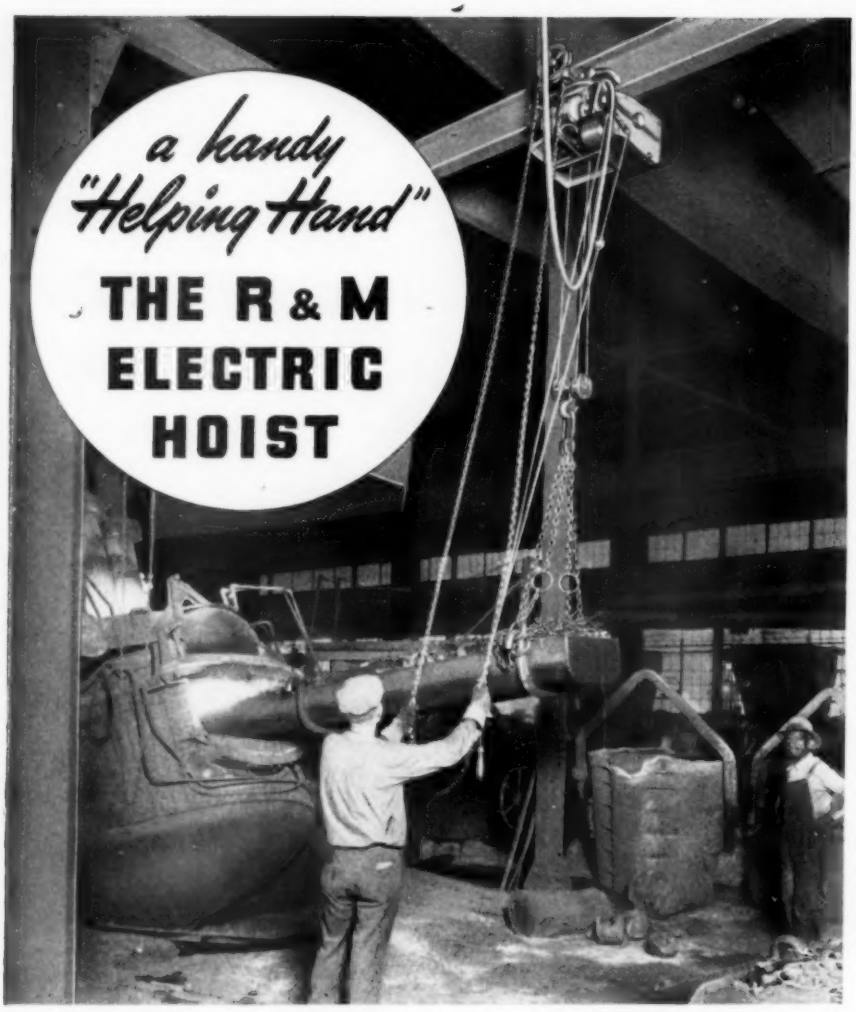

• Robbins & Myers electric hoists do *so many things*—fit into so many locations—that foundries everywhere find them effective aids to *higher* output, *lower* production costs.

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MOTORS • HOISTS • CRANES • FANS • MOYNO PUMPS

(*Continued from page* 194)

metal to flow around the chill, unless an unusually large chill is used, in which case more clearance should be allowed.

Set the dried drag frame face up on the lower cast iron plate so that the outlines of the plate and frame coincide. Then place aluminum spacers on the parting surface of the drag mold which will determine the thickness, outside contour, and gate for the plate casting. Fig. 8 illustrates these spacers in place on the drag mold.

Put pins in drag frame and lower cope mold on pins face down on top of spacers. Now place a wire which has a 90 degree hook in slot in top of cope frame (see Fig. 4) allowing the hook to be near the 2-in. hole in cope mold. Now place top plate in position on cope mold. Fig. 6 shows the setup as assembled thus far and in addition shows the hook in final position and shows the trip lever mechanism used to allow the metal to be let into the mold.

Place two 8-15/16-in. diameter sheets of 12-lb sheet asbestos in the hole in the top plate in such a manner that the hook on the wire goes through both sheets of the asbestos paper in the location as shown in Fig. 6.

Mold Is Clamped

Clamp the whole mold assembly together with C-clamps. The metal retainer for the pouring basin is then placed in position on the top plate and clamped with the two hooked clamps. The plaster pouring basin is inserted in the retainer and weighted down with a bar.

The metal is melted and fluxed in the conventional manner and then chilled back until the metal is partially solidified or in a mushy condition. This is the point at which the metal is quickly poured into the pouring basin, the weight removed and the cover quickly clamped in place. The air is turned on which allows air to enter at the center of the cover until approximately 2 psi is reached (too great a pressure will cause casting to swell in the center), then the trip lever is pulled and the mold is filled by the action of the wire hook tearing the asbestos paper which allows the metal to enter the down sprue.

The air should be left on until the metal is solidified. The casting is taken out after cooling (2 or 3 hours or more) and plaster removed with wood sticks and water. Chill stems (none in this case) are cut off and gate removed. If the plate is made

(*Concluded on page* 198)

UNIQUE DUST CONTROL HOOD...

SAVES SPACE GIVES BETTER LIGHT!!

Shown above is an abrasive polishing operation in the Mechanics Tool & Forge Co. Note how totally enclosed hood permits efficient working position for operator.

Illustrating the ingenuity of KIRK & BLUM Engineers is a recent installation of grinding hoods at the Mechanics Tool & Forge Co., Sabina, Ohio. To fit space limitations and to avoid interference with lights, all dust collecting piping was installed in trenches below floor level. In doing this, Kirk & Blum grinding hoods were adapted to "top-of-wheel" grinding which offers many advantages in the grinding of hand tools.

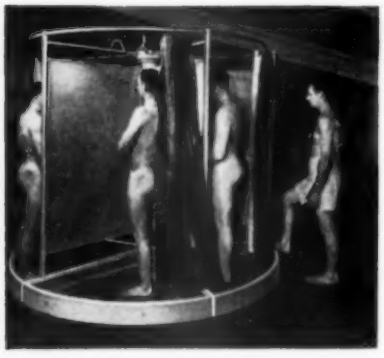
If you have a problem involving dust collection and metal fabrication, call on KIRK & BLUM Engineers. Their experience can be a valuable asset in your plant. The Kirk & Blum Mfg. Co., 2808 Spring Grove Ave., Cincinnati 25, Ohio.

FOR CLEAN AIR... THE INVISIBLE TOOL

KIRK AND BLUM

DUST CONTROL SYSTEMS

INCLUDE SHOWERS IN THE MODERN WASHROOM

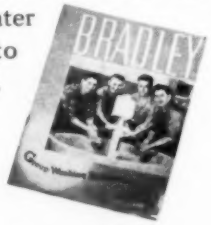


• Alert plant executives know that sanitary wash facilities, to be complete, should include showers. Efficiency and employee morale are definitely improved when the convenience of clean, health-protecting showers is made available.

Bradley Multi-Stall Showers combine the benefits of economy and easy installation with sturdy construction and maximum sanitation.

Available in 5- or 3-Stall Units, Bradleys can be quickly installed in either old or new buildings, on any kind of floor including wood. Bradleys have no corners or dark areas to collect dirt, and upkeep requires a minimum of attention.

For further details on how Bradley installations reduce the number of piping connections needed, cut hot water costs and reduce water consumption, write to BRADLEY WASHFOUNTAIN CO., 2217 W. Michigan Street, Milwaukee 1, Wisconsin.



Illustrated Catalog 4701 includes helpful layout suggestions, - a copy sent promptly upon request.

Distributed Through Plumbing Wholesalers

BRADLEY multi-stall showers

(*Concluded from page* 196)

properly very little clean-up work will be required.

A list of precautions to be observed in making pressure cast aluminum match plates are as follows:

(1) Keep all parting surfaces as horizontal as possible. If parting surface is over 75 degrees with the horizontal, the plate will be too thin at that point. A vertical parting surface will make a hole in the plate corresponding to the position of the vertical parting surface.

(2) Do not use any lumpy plaster; these lumps are set plaster and will cause the mix to set too fast and the dried molds will shrink too much.

(3) Don't make frames (Fig. 4) out of any alloy that will expand on heating more than cast iron, so that plaster will not crack in oven.

(4) If a plaster of paris follow board is made, be sure to apply green plaster separator to the flat plaster surface of the follow board before pouring the cope mold.

APPENDIX

Separators:

Green plaster molding (plaster from plaster)

1. One part palm wax, five parts naphtha by weight. Melt the wax and pour it into the naphtha. This should make a very thin solution.
2. One part yellow ceresine wax, five parts of toluol by weight. Melt the wax and pour it into the toluol.

Note: In using the separators in (1) and (2) it is important that thin solutions be used that are cool, at least no warmer than the mold on which they are applied.

Molding from pattern, (metal or wood)

1. ½-pint kerosene, ½-pint lard oil, and 1 teaspoon of fine powdered mica. (Note: The addition of mica can be omitted for patterns without difficult draws).
2. Machine oil and kerosene.
3. Stearic acid and kerosene.
4. Lard oil and gasoline.
5. Graphite and oil (machine or lard oil). (Note: This separator should only be used on patterns having difficult draws. The more difficult the draw the thicker the graphite will have to be applied to the pattern).

Metals:

1. 95 per cent aluminum, 5 per cent silicon (No. 43 alloy).
2. 92 per cent aluminum, 7 per cent silicon, and 1 per cent copper.

Note: No. 2 is the alloy recommended. It is not as soft as No. 1 and casts nearly as well.

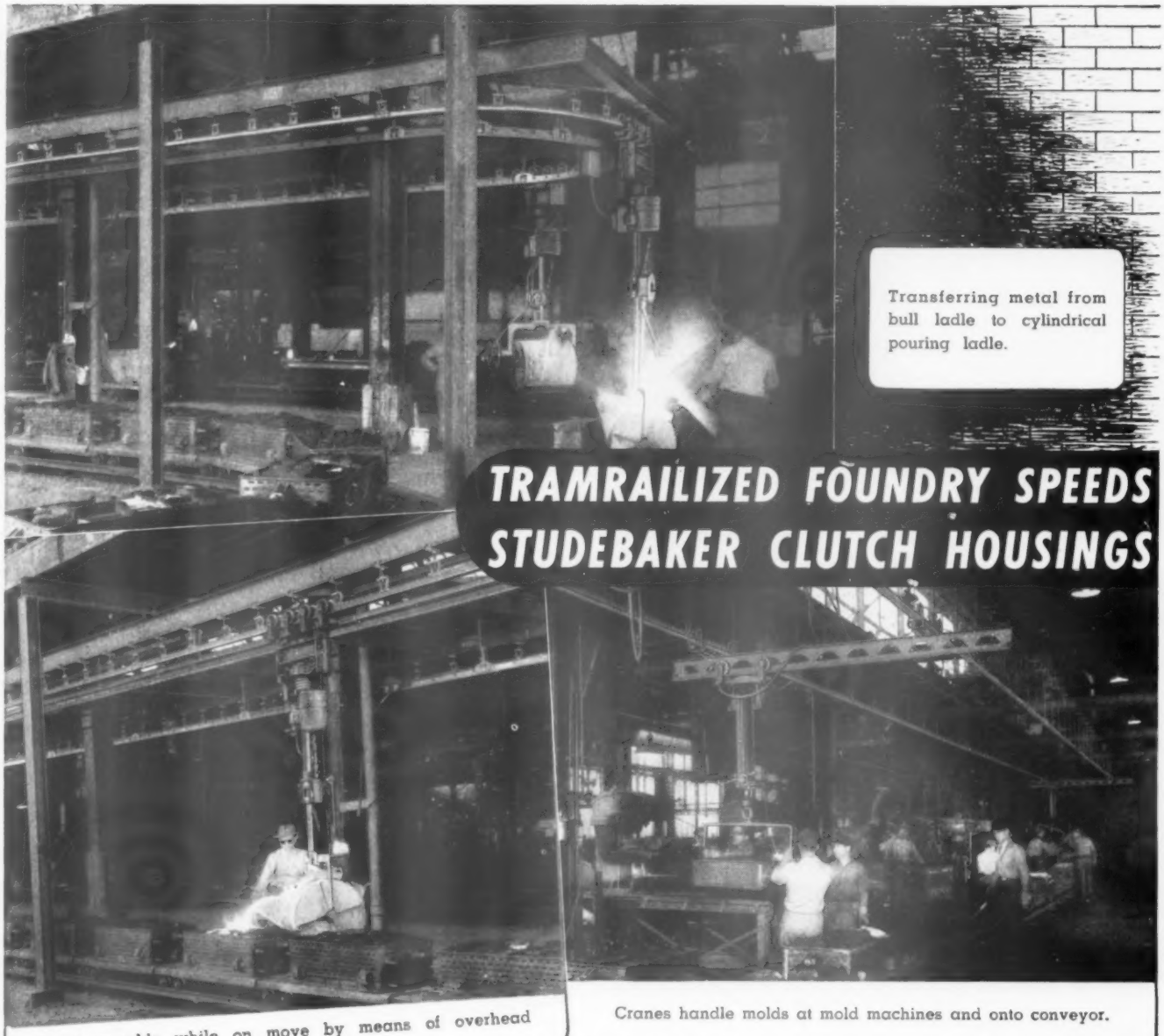
Molding Plaster Compositions:

Five parts No. 1 molding plaster, one part fibrous talc.
5 parts marble dust.

Note: The above proportions are by weight. The dry ingredients are thoroughly mixed. The correct proportions for making plate molds is 1 part cool water to 1.128 parts of "plaster" (the mixture of dry ingredients). Add the "plaster" to the water and mix thoroughly being careful not to whip air into the mix.

Note: Both the U. S. Gypsum Co. (300 West Adams St., Chicago 6) and the National Gypsum Co., (325 Delaware Ave., Buffalo, N. Y.), make a premixed fibered plaster that is used for this work, which could be substituted for the composition given above.

Dravo Corp., Pittsburgh, has appointed Harry F. Haldeman Inc., Los Angeles, distributor in southern California for its line of counterflow heaters for industrial and commercial buildings. The Haldeman company specializes in heating, ventilating and air-conditioning equipment.



Transferring metal from bull ladle to cylindrical pouring ladle.

TRAMRAILIZED FOUNDRY SPEEDS STUDEBAKER CLUTCH HOUSINGS

Pouring molds while on move by means of overhead synchronized chain-driven Tramrail system.

Cranes handle molds at mold machines and onto conveyor.

● Cleveland Tramrail equipment is a primary factor enabling fast production of clutch housings in a special department devoted to this item at the Studebaker Corporation, South Bend, Indiana. Cranes with air hoists ease the work of mold preparation and handling onto the conveyor. A chain driven Tramrail system, on which the pouring ladles ride, is synchronized with the mold conveyor, permitting molds being easily poured while in motion. The rate of production is such that 138 cars pass a given point per hour. For the investment involved, no other foundry equipment offers as great possibilities for speeding production, reducing cost, easing the work and aiding safety as Cleveland Tramrail.

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THE CLEVELAND CRANE & ENGINEERING CO.
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CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

THE ADVENTURES OF *Bill*

By PAT DWYER

Drawings by RICHEY

ONE OF the seven wonders of the world to me," Bill said the other day, "is how these lads and lassies who write books about themselves can set down every word they said to each other over a period of 40 or 50 years, going back in some instances to the days when they had to be fed out of a bottle, washed in a dishpan and hung out on the line to dry. I have a fair to middling memory. I can remember jobs I made when I was an apprentice, and can remember the names of most of the men with whom I worked, but most assuredly I can't remember a word of our conversations. Can you remember a single word you ever said to your father, or a single word your father said to you, in the period when you probably were a thorn in his side between the ages of, say, one and fifteen?"

"Well," I said, "I won't claim that I can repeat the exact words, but I have a very distinct recollection indeed of the very few occasions when my father gave us a glimpse of incidents in his life when he was a gay caballero, without a thought of what he should eat or what he should drink, or where he was going to raise the stuff to meet the inevitable and hurrying rent day. Although exceptionally well read for the time and place, he was a man of few words. My mother handled most of the conversation—and everything else—around our house. She did not have much formal education, but I would have no hesitation in matching her against any financial genius in the art of stretching a dollar.

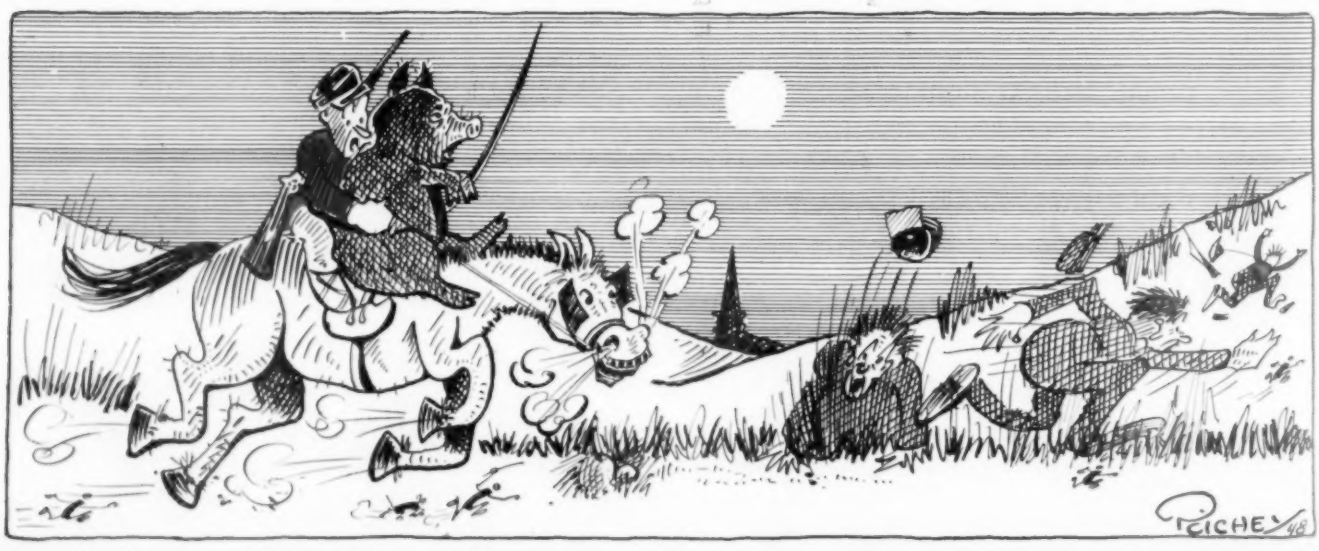
"Away back in the early 60's, while a resident of the great city of New York, my father had contributed his humble bit to saving the Union. This does not mean that in a fit of burning zeal he rushed down to Washington and offered his shining sword and services to Lincoln for a modest consideration. Not at all. He was quite satisfied with the job he had in New York. He knew little and cared less for the great internecine struggle in progress at that time. He had not the faintest desire to shoulder a gun and shoot down a bunch of innocent strangers with whom he had no quarrel. He had even less desire to expose his precious person as a target to large or small bodies of men with whom he never had any dealing of any kind. One day, to his astonishment, before he knew what was happening and before he had an opportunity to arrange his small affairs, he found himself surrounded by a uniform, either designed for a giant or designed on the theory that, in the great out doors, the cloth was bound to shrink. As a plain matter of fact, the suit was pretty well shrunken to a few wisps and tatters by the time he shed it two years later.

"He might as well have been a mole so far as his participation in the siege of Vicksburg was concerned. Every day, under the vinegary tongue lashing of a brutal sergeant enjoying a little brief authority, the men were kept digging trenches and more trenches. The only use they had for their carbines strapped across their backs, was as life savers when they stumbled above ground and fell into one of these gaping gaps in the ground. The gun caught on both sides and kept the stumbler dangling until some one heard his yells and came to his assistance.

"With the laudable intention of adding a little variety to the drab and monotonous camp menu, three or four of the boys drifted out of the camp one night and were lucky enough to pick up a few trifling odds and ends. To avoid any friction or unpleasantness, they went about the work in perfect silence and carefully muzzled any dog who showed a disposition to bar the way or notify those who might not welcome the strangers. In the majority of instances they had to step warily to avoid the bear traps, dead falls and concealed pits—too wide to be spanned by a carbine—with which the timid and suspicious souls surrounded their houses and barns.

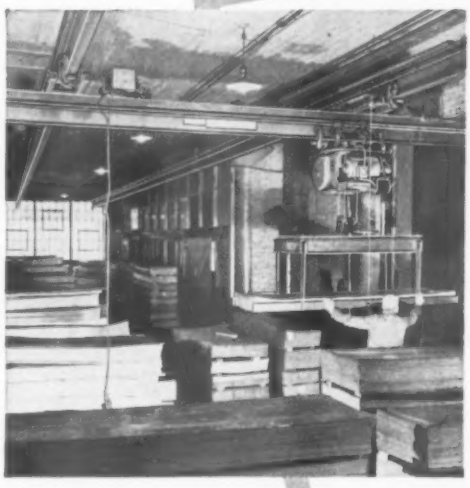
"On this particular night my father picked up a half grown pig. To smother its squeals he cut the pig's throat, and then in a spirit of bravado he ripped the body open in front from chin to curly tail. The same whimsical spirit prompted him to hold the pig upright in front of him on the horse. A small party of the enemy,

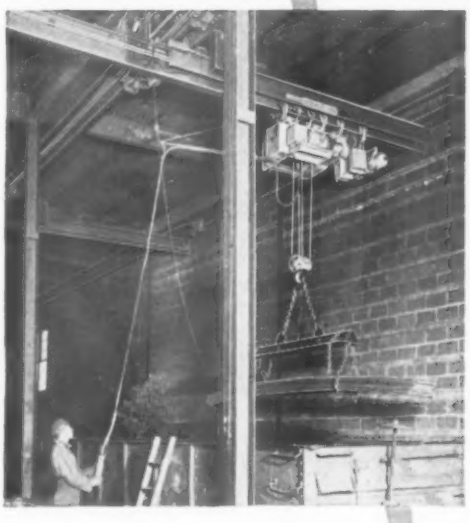
(*Continued on page* 202)



If you had been carefully ambushed, would you have attempted to stop this gory combination? Yes, you would!

5-Ton Low Headroom MONORAIL CRANES





AMERICAN MONORAIL 5-Ton Cranes furnish efficient operation where headroom is a critical problem. Twin-bridges with carrier mounted between bridges bring load clearance to uppermost limit for extreme low headroom operation. American MonoRail Low Headroom Cranes operate by cab or from floor by finger-tip control. Interlocking devices permit carrier to travel beyond craneways. Loads are moved over maximum area, every square foot of operating and storage space is served. Cranes can be installed under present operating conditions without excessive structural changes.

An American MonoRail Engineer will be glad to discuss the possibilities of crane operation in low headroom areas regardless of the type of handling.

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For complete information on these products and their application, as well as other eye and respiratory protective devices, get in touch with your Willson distributor or write us direct.

*T. M. Reg. U. S. Pat. Off.

WILLSON PRODUCTS, INC., 237 WASHINGTON STREET, READING, PA.

(*Continued from page* 200)

carefully lying in ambush, fled in terror when a horse came tearing down the road apparently ridden by a wide open pig and waving a sword over its head."

"Well," said Bill, "I'll tell you. I never carried a gun with hostile intent, never dug or fell into trenches, and never stole a pig. My experience with pigs has been confined to the variety that is thrown into the cupola. I don't think I ever told you about a mild bit of long distance bickering I had one time from a gent over the water.

"Every once in a while I get an inquiry on the subject of slag wool. The inquirer usually wants to know what it is, where it comes from, and what measures are necessary to either prevent the formation, or to get rid of it. Replies to this question have been presented in THE FOUNDRY on several occasions. Publication of one answer some time ago brought a sharply dissenting opinion from a foreign reader. Well, I discovered long ago that the average foundryman has the most implicit faith in his own opinion and a correspondingly low estimate of opinions held by others. Here, I'll cite you an example. Following is the reply sent to a slag wool inquirer. Also the dissenting opinion as expressed by our critical correspondent:

Slag wool flying freely from the cupola slag hole usually is regarded as an indication that the melting process is going forward in a highly satisfactory manner. For that reason the slight nuisance created by adherence to the walls, beams and roof has been tolerated as a necessary accompanying evil involved in the production of castings. A good housekeeping program spreading throughout the foundry industry in recent years gradually is eliminating this undesirable condition as is indicated in the following several examples which show what can be done in any foundry encountering this trouble.

In new installations the cupola is walled off from the remainder of the foundry. The slag wool is discharged into this room where it either falls to the floor, or adheres to the walls and roof, from which it may be brushed down periodically. In a prominent eastern foundry where an air suction system is used for removing dust from the shakeout, sand conditioning and casting cleaning units, a branch pipe is adapted for removal of the slag wool from the cupola. A rectangular sheet steel funnel is suspended about 2 ft back of the slag hole and is connected to a 4-in. pipe leading to a discharge or storage bin.

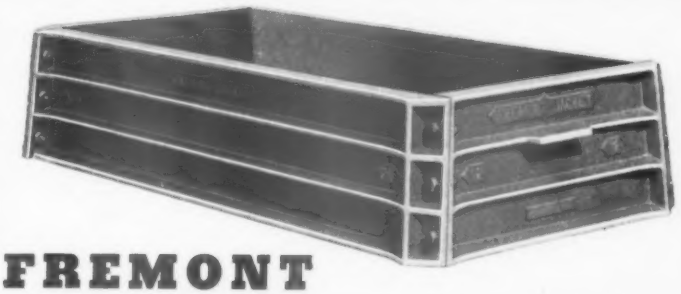
The general idea is subject to many variations. The funnel might take the form of an elbow with the lower, or discharge end, above a buggy, close to the floor, or in a

(*Continued on page* 204)

FREMONT

MAGNESIUM FLASKS

ACCURATE-LIGHT-STURDY



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The Campbell-Hausfeld Co.

300-320 MOORE ST. HARRISON, OHIO

(*Continued from page* 202)

shallow pit in the floor. Proper distance between funnel and slag hole is determined by observation. If too close, the fiery blast will burn a hole through the upper wall of the funnel. If too far away it will not catch the entire shower of sparks. Thirty odd years ago I knew an ingenious foundryman who salvaged a 16-in. cast iron elbow from the scrap pile, lined it with brick and hung it up behind the slag hole to prevent the fiery steam from setting fire to the back wall of the cupola room.

"In a later issue of THE FOUNDRY a British reader, politely, of course, but definitely begged to differ with the foregoing answer. He wrote:

As a reader of your journal for many years and also having spent most of that time in connection with cupola control, the writer is tempted

Old musket never let him down

to say in the English vernacular, 'Don't you believe it!'

The fact that slag may wool freely under *certain conditions* of cupola operation may indicate good fluxing conditions, but to the writer, the formation of slag wool is more likely to indicate air leaks (often due to cracks in welded pipes) through the air belt near the slag hole, or to an incorrectly made slag hole, allowing the air to leak around the hole and so blowing the slag into wool. It is submitted that efficient cupola practice and good housekeeping should not permit the formation of slag wool. If one wishes to snap judge cupola practice by slag, the correct symptoms to look for are free flowing slag associated with high temperature.

"In these critical times," Bill continued, "with nerves on edge and all that kind of stuff, I would not like to shoo the dove of peace off the nest, or make even a light pass at chips on shoulders, but I would like to quote some authorities to show that I am not alone in my views on the slag wool question. I wish you

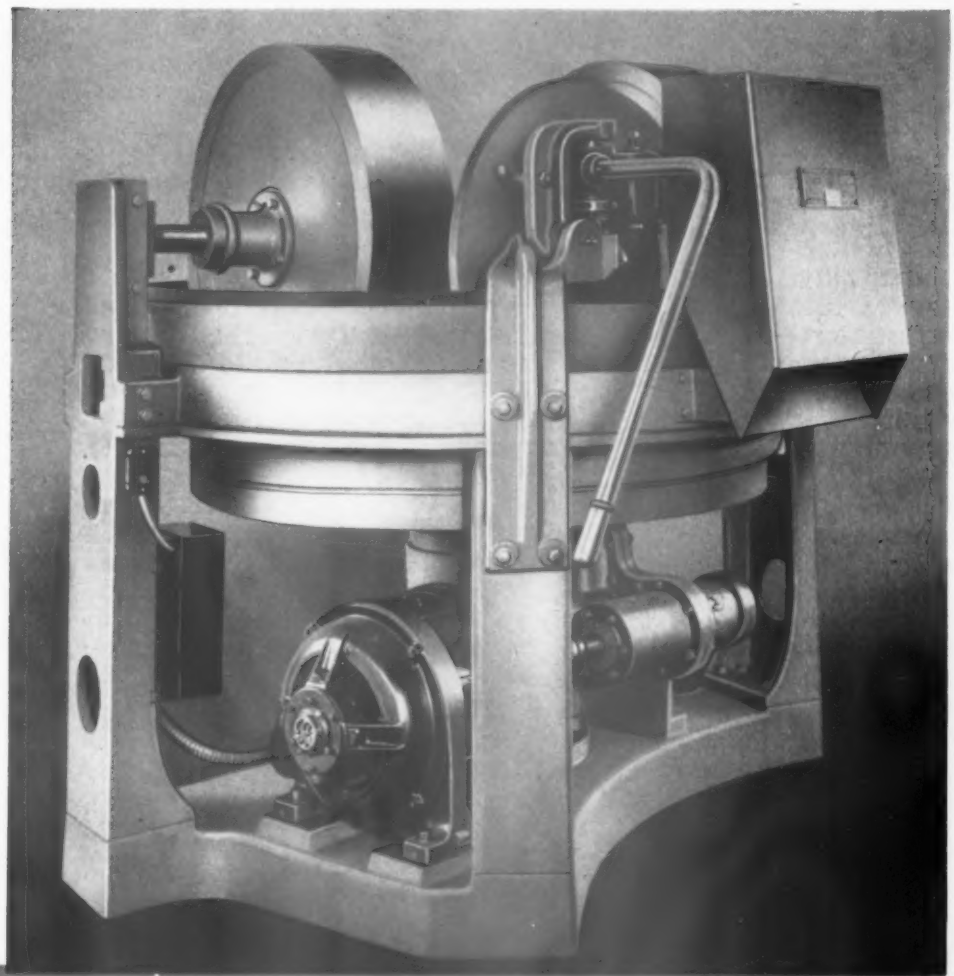
(*Concluded on page* 206)

YOU SAVE SPACE

with a *Clearfield* MIXER

No matter how large the capacity of the Clearfield Mixer you need, you'll find it has been designed for utmost compactness—saving you valuable space. The center of gravity of all Clearfield models is low, requiring minimum head room. All frame parts are supported from floor level, eliminating the need for any foundation pits or concrete piers. A Clearfield Mixer can be installed any place where there is a solid, level floor.

For the best in efficient, economical mixing equipment, write today for Catalog No. 79.



CLEARFIELD MIXER

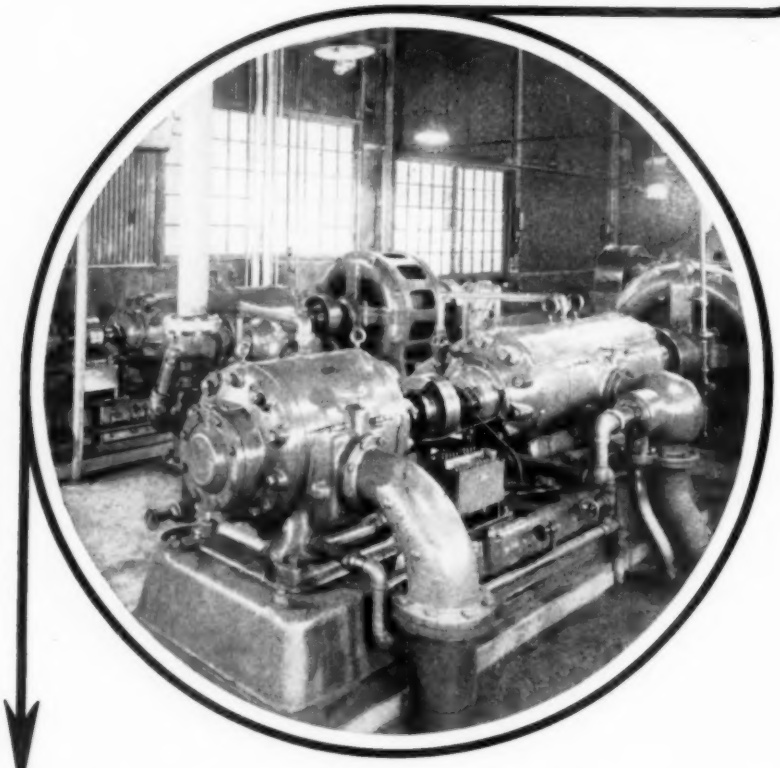
MIXES, TEMPERS AERATES

CLEARFIELD MACHINE COMPANY

CLEARFIELD PENNSYLVANIA, U. S. A.

HERE'S WHAT YOU GET WITH A

Fuller Rotary Compressor



DIRECT DRIVE . . . ACCESSIBILITY . . . LOW MAINTENANCE . . . SIMPLE FOUNDATIONS . . . BLADES AUTOMATICALLY COMPENSATE FOR WEAR . . . SMALL FLOOR SPACE WITH RELATION TO CAPACITY . . . MAINTAINED CAPACITY FOR THE LIFE OF THE MACHINE . . . UNNECESSARY BULK ELIMINATED . . . NO BEARING TAKE-UP . . . NO LEAKING VALVES OR SEATS TO GRIND . . . NO AIR-LINE PULSATIONS . . . NO MULTIPLICITY OF PARTS REQUIRING FREQUENT ATTENTION, ADJUSTMENT AND REPLACEMENT.

For years Fuller engineers have striven to build the best compressor money could buy . . . simple in design, easily operated, rugged construction for long, continuous service. With these thoughts in mind, it is natural that only the best of materials and workmanship go into the makeup of Fuller Rotaries. This continued effort has paid dividends, as is shown by the thousands of machines in operation and the many repeat orders from satisfied users.

An ideal unit for any plant. It will pay you to consider the outstanding features of these efficient machines. Write for Bulletin C-5 describing and illustrating Fuller Rotary Compressors.

FULLER COMPANY

CATASAUQUA—PENNSYLVANIA

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C-175

FULLER

A LIFETIME OF NEW MACHINE EFFICIENCY

(*Concluded from page* 204)

would kind of rally around. Take a peek at some of the published work of a few standard authorities, so that if and when another critic appears above the horizon, I may be in position to repel boarders.

A few days later I handed him a quotation from the *Handbook of Cupola Operation* recently issued by the American Foundrymen's Association. Several hundred firms and individuals had a hand in compiling this volume. Its comments on slag wool are as follows:

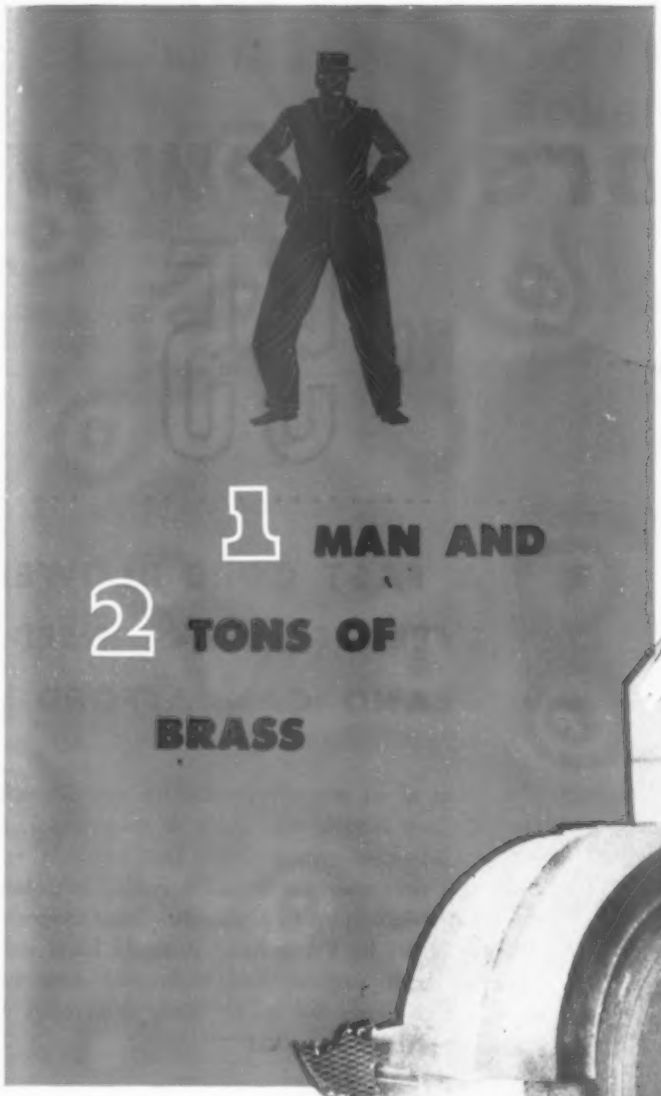
Quantities of light, filmy, wool-like substance are observed around the open slag hole, especially after the slag begins to flow freely. This substance is slag wool made by the atomizing action of the blast on the molten slag. It is similar to rock wool used for the insulation of buildings, which is made by melting limestone and sand in a cupola and atomizing the molten mass with a stream of steam. Slag wool accumulates on the ceiling, rafters, windows and machinery where it rapidly helps gather dust and therefore is a source of dirt and untidiness. Since it is a fair indicator of good slagging conditions, it is not good practice to change the slag composition to eliminate it. Some operators use a fire brick cover over the slag spout to eliminate the slag wool nuisance. As a good housekeeping measure, some equipment should be designed to prevent the accumulation of this unsightly mass in the general location of the cupola.

A prominent mid-west foundryman has given some thought to the slag wool problem and has proposed a combination exhaust-washer arrangement as a method of eliminating the wool and keeping the cupola area clean. The unit consists of an exhaust fan which sucks the slag wool through a series of water sprays. The suction intake is back a few inches from the slag spout so that the slag can flow freely into a slag buggy. If desired, the intake can be formed by a longer pipe than can be telescoped into the water spray booth enclosure when more room is required at the slag spout for patching or for opening a clogged slag hole.

The enclosure is made of sheet and angle iron. The water spray is made by drilling small holes along a 1 1/4 to 2-in. pipe to deliver fine jets of water across the air stream, thus carrying the slag wool to the bottom of the enclosure from which it can be removed from time to time. Clean out doors also are provided at the side of the ducts and spray booth.

A typical unit is for a 60-in. diam. cupola and requires a 6-hp exhaust fan. The fan discharges outside the building into a screened enclosure, formed with expanded metal, to arrest any wool that may be carried through the water spray. The water can be supplied from the foundry main, or it can be circulated by pumping it from a sump into which the waste water is returned by gravity.

"Bingo!" Bill exclaimed. "That's all I need, and more!"



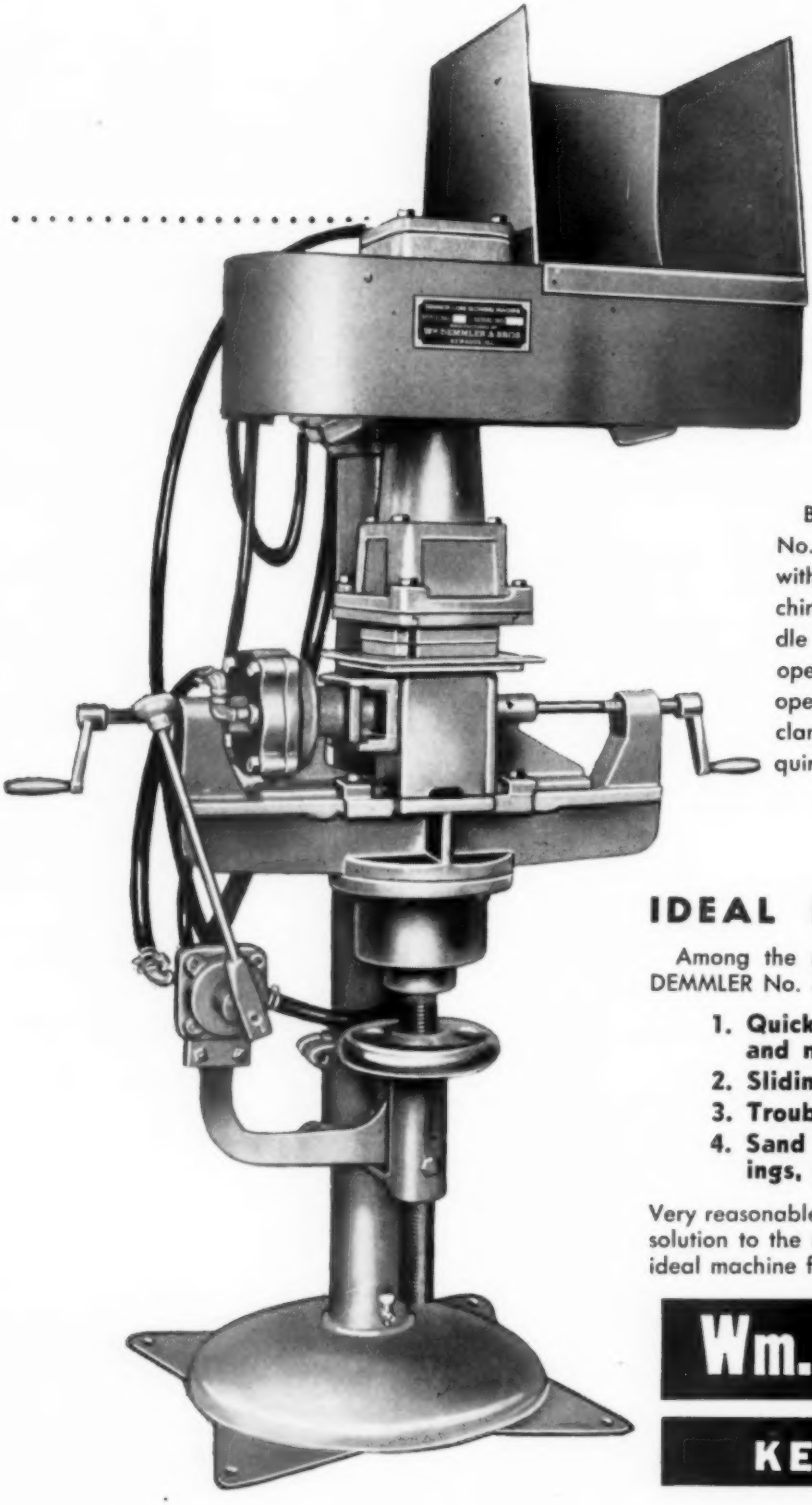
Talk about fast metal melting at low cost!—the Type LF, 200 lb. DETROIT ROCKING ELECTRIC FURNACE illustrated below melted more than *two tons of red brass in one day's typical operation by one man.* In just 9 hours, this small and compact unit melted 27 heats of leaded bronze—200 lbs. per heat—for a total of 5400 lbs. *Power consumption, only 281 Kwh per ton.* Simple DETROIT ELECTRIC FURNACE design makes one-man operation easy. Non-rotating electrodes, supported by brackets mounted on the base, receive power from either overhead or below via copper conductors. Withdrawing electrodes frees shell for easy interchange to permit melting heats of various analyses. All controls are at operator's fingertips, assuring quick, positive regulation of melting time, composition, and other melting factors. Send us your ferrous and non-ferrous metal melting requirements. We will recommend the specific DETROIT ELECTRIC FURNACE—available in 10 lb. to 8000 lb. capacities—to speed quality metal production in your plant.

DETROIT ELECTRIC FURNACES

DETROIT ELECTRIC FURNACE DIVISION • KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

FOREIGN OFFICES: BIRLEC LTD., Birmingham, England, Representative for Europe and British Commonwealth excluding Canada. EQUIPAMENTOS INDUSTRIAS "EISA" LTD., Sao Paulo, Brazil, Representative in Brazil. M. CASTELLVI, INC., 150 Broadway, New York 7, N. Y., Representative in Chile, Argentina, Peru, and Venezuela. CASA COVACEVICH, Mexico City, D. F., Mexico.

DEMMLER Core Blower NO. 55



A FAST CORE BLOWER EVERY FOUNDRY NEEDS AND CAN AFFORD

Because of its many features, the new Demmler No. 55 Core Blower was quick to gain popularity with foundrymen everywhere. This versatile machine will accommodate boxes 9 inches long—handle cores weighing up to 3 pounds. Sand magazine opening is 4½ by 9½ inches. A single hand valve operates both vertical and horizontal core box clamps and blows the core. Only 3 seconds required for complete cycle!

IDEAL FOR SHORT RUN JOBS

Among the many high quality features found on the new DEMMLER No. 55 are:

1. **Quick, easy adjustments for raising the table and moving chuck jaws.**
2. **Sliding, quick change blow plates**
3. **Trouble-free diaphragm type blow valve**
4. **Sand magazine and carriage of aluminum castings, with ball bearing rollers**

Very reasonable in price, the DEMMLER No. 55 is the economical solution to the rapid production of high quality small cores—an ideal machine for any foundry whether large or small.

Wm. Demmler & Bros.

KEWANEE, ILLINOIS

SEND FOR ILLUSTRATED SPECIFICATION SHEET

Apprentice Winners List Revised

THE FOUNDRY regrets that two prize winners in the 1948 annual apprentice contest of the American Foundrymen's Association were listed incorrectly in the article presented in the June issue, p. 124. The errors occurred in the AFA national office in transcribing from score sheets submitted by the contest judges.

Winner of third place in pattern-making should have been announced as Robert J. Schneider, apprentice

ROBERT J. SCHNEIDER

employed by the Midwest Pattern Co., Minneapolis, while second-place winner in steel molding actually was Joseph J. Wienclawski, Birdsboro Steel Foundry & Machine Co.

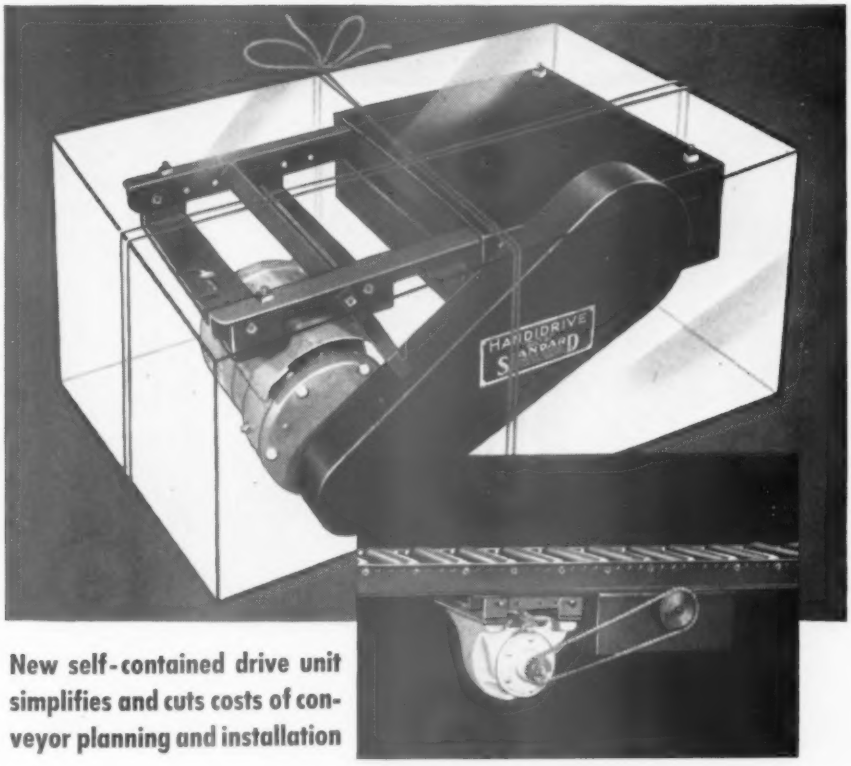
Inspection of Iron Microstructures

Committee on Microstructure of Cast Iron of American Foundrymen's Association has begun preparation of a comprehensive analysis of metallographic techniques for iron now in general use, to be released to the field as the first in a series of reports. Aim of the reports is to provide industrial laboratories with detailed information through which to obtain the most satisfactory results in the inspection of iron microstructures.

Committee members include: H. W. Lownie Jr., Battelle Memorial Institute, Columbus, O., chairman; Prof. Robert W. Lindsay, Pennsylvania State College, vice chairman; C. A. Johnson, Armour Research Foundation, Chicago, secretary; William R. McCrackin, Cooper-Bessemer Corp., Grove City, Pa.; Alfred Boyles, U. S. Pipe & Foundry Co., Burlington, N. J.; and D. L. Edlund, Vanadium Corp. of America, Bridgeville, Pa.

New "Power-Package" Unit for Roller and Belt Conveyors

THE STANDARD HANDI-DRIVE



New self-contained drive unit simplifies and cuts costs of conveyor planning and installation

Here it is! A packaged power unit that gives every conveyor user the opportunity to be his own layout engineer — to change his conveyor system to suit varying plant conditions in a minimum of time!

Converts gravity conveyors to live belt or roller conveyor quickly . . at low cost

The Handi-Drive is designed to provide quick, simple conversion of an ordinary roller conveyor to a moving or "live" belt conveyor or a conveyor with power driven rollers. Equally important, using standard units you can build a conveyor system custom-planned to your individual plant needs. Units are stocked at the factory — get them now!

If you want to convert your present gravity conveyors to powered units — or if you want to install your own new system . . . send for the Handi-Drive Bulletin No. F-78. It gives you complete design information and prices — tells you how to lay out your system, gives complete data on inclines, belt and roller widths, curves, weights to be handled and types of packaging or units to be moved. Write: Standard Conveyor Company, North St. Paul, Minnesota.

SEND FOR HANDI-DRIVE BULLETIN

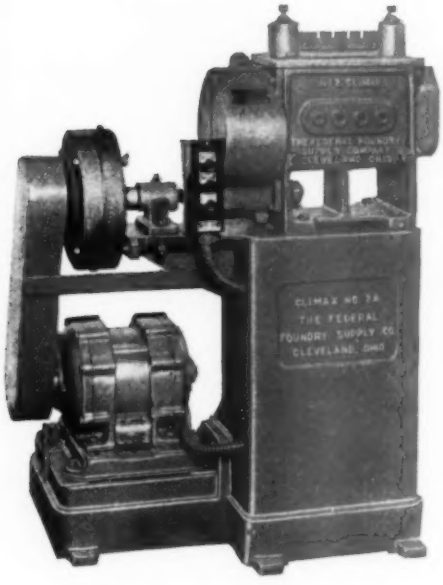
Standard
GRAVITY & POWER
CONVEYORS

FEDERAL SUPPLIES

FEDERAL'S LOWE SIFTER

Save money by faster sifting, better sand conditioning with a Lowe Electric Sifter. Features: greater screening area, enclosed ball bearing motor, more shoveling room. Write for information. Prompt delivery.

CLIMAX WIRE STRAIGHTENERS



Any foundry, large or small, can cut production costs by straightening and reusing core wires and rods. With a Climax Wire Straightener this can be done quickly, economically, safely — by unskilled labor. A complete descriptive circular is yours for the asking.

The "Lightning" Clamp

The "Holdtite" Clamp

CLAMPS

Federal offers two types of flask clamps.

The "Lightning" clamp is an eccentric type, requiring no wedges and available in two sizes: No. 2, 8" to 12" and No. 3, 12" to 20".

The "Holdtite" is an adjustable clamp designed for use with wedges and is also offered in two sizes: No. 1, 13" to 23" and No. 0, 18" to 33".

Both clamps made of sturdy malleable iron, rigidly reinforced to prevent distortion.

FEDERAL'S WONDER CUTTERS

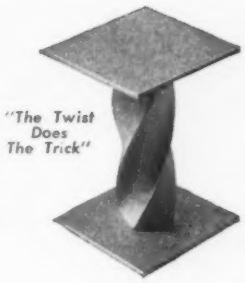
Two compact cutters for rods and band iron. One cuts up to 5/8" round and the other to 7/8" round. Readily mounted on any bench. Users say they're worth their weight in gold!

RUBBER-COVERED SHOVEL HANDLES

The best insurance you can buy against damaged patterns, core boxes or flasks. The pean-shaped grip is ideal for ramming.

They will fit your present shovels or you can order your next shovels with them already installed.

TWISTED STEM CHAPLETS



The chaplet with everything. The "Twisted Stem" promotes rapid complete fusion. Not deformed, the stem has no weak spot to burn in and permit core shift. Made in a complete range of sizes. Samples of the size you use, gladly submitted.

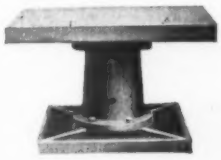
WATER BRUSH

Easy to Grip and Hard to Tip. It can't leak and one filling lasts all day. Does not tire the molder's hand.

BLAST CLEANING NOZZLES

Air consumption is reduced and the blast is concentrated because the hole in the nozzle wears very slowly. Made in all sizes and types. Write for circular.

FEDERAL JOLT MACHINES



Air operated, fool-proof jolt machines that ensure uniform cores. Sturdy cast iron construction with no external valves to wear out. Made in four sizes. Get our prices and deliveries.

SHUR-SPOT SPRUE

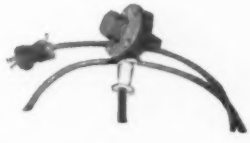
Designed for use on squeezer-made molds, Shur-Spot squeezes right down with the sand. When the squeezer board is removed, the Shur-Spot pops up and can be lifted right out. The result is a fully completed and properly located pouring sprue that requires no finishing. Shur-Spot Sprue eliminates danger of falling sand.

For complete information on the Shur-Spot Sprue, write for the circular on this low-priced easy-to-use item.

FEDERAL'S "VIBRA-DRAW" CORE DRAWING MACHINE

Cuts costs in your core room by making it easy for every core maker to draw perfect cores as fast as he can fill the core box, place it against the vibrating head and lift the box. Made in two styles: the floor model and the portable bench model shown below. Immediate delivery—write for details.

FEDERAL VIBRATOR No. 2 and 5



Federal's own make and available for immediate delivery. Hard-chromed piston guarantees long life. For 110 volt, 60 cycle, single phase operation. $15.60 each, f.o.b. Cleveland; No. 5 for heavier duty—$20.40 each.

Federal also has a new "convenience outlet knee switch." No taping, soldering or wiring. Plug in—that's all. Carried in stock. $6.50 each, f.o.b. Cleveland, Ohio.

THE FEDERAL FOUNDRY SUPPLY COMPANY

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LaGrand Industrial Supply Co., Portland, Ore.

Man-to-Man

ON THE MOLDER'S BENCH

"More and Better Gossip"

By RALPH L. LEE

IT ain't so much what we don't know that hurts us as it is what we do know that ain't so."

I've been crediting one wise friend of mine after another with this little bit of wisdom, but the other day I read some place that it was first said way back long before my time. What gets me is how these truths can be manhandled down through the ages only to land right side up today just as though they had been tailor-made for the problems that are pestering us right now.

Norm Rockwell, the *Saturday Evening Post* artist most everyone knows, painted a cover not so long ago on the subject of gossip. It showed a juicy morsel starting out and each connecting link in the old grapevine telegraph. Whether over the telephone or from mouth to ear you could see the catty glee on the faces of those picking up or handing out the dirt. The pay-off came in the last frame where the victim came face to face with the gal who started the whole rumpus.

While there wasn't one word of explanation, it was just as plain as day that there hadn't been one word of truth in the whole affair. Of course, Norm Rockwell would have to use a woman for starting the trouble as women are usually given credit for being tops when it comes to gossip. On the other hand it strikes me sometimes that women aren't one-two-three compared to men, particularly when the latter are working together in the shop.

Talk about television and radio spreading information, sometimes it seems to me that they are slow compared to the shop grapevine. It's nothing short of a miracle the way stuff gets around—accurate dope, inaccurate, downright lies, good information, bad information and plain ordinary drivel. If it were all harmless it wouldn't be so bad, but sometimes people, jobs and companies are pretty nearly wrecked as a result of it.

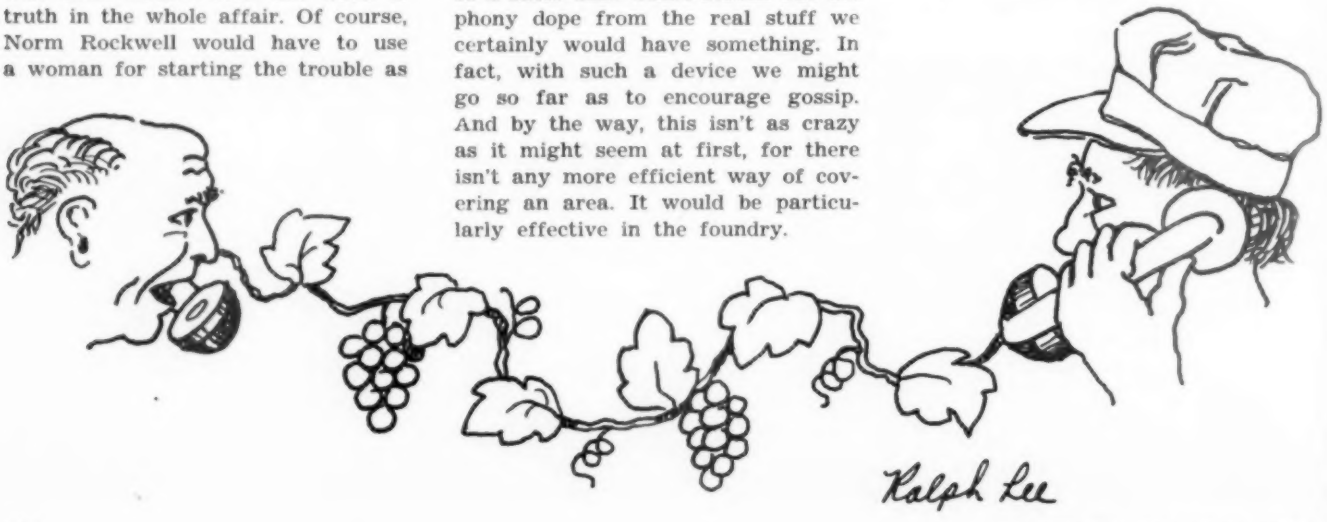
I think if we got into it we would find that most of our employee relations, squabbles and bickering can be traced to the *things people know that ain't so* they picked up tapping the grapevine telegraph lines, either the lines running through shop or those running around the neighborhood near the shop.

If we could only invent some sort of a filter that would screen out the phony dope from the real stuff we certainly would have something. In fact, with such a device we might go so far as to encourage gossip. And by the way, this isn't as crazy as it might seem at first, for there isn't any more efficient way of covering an area. It would be particularly effective in the foundry.

The reason I say foundry is this. Take the jolt squeeze machines that are whamming all around me as I go through a foundry and add to that racket the ungodly din of the tumbling mills and shakeout. I have found that I might just as well give up trying to hear what my guide is yelling into my ear, let alone ask a question. I wait till I get back into the office where I try to remember what I wanted to know.

In view of this I can't help but think of the boys who work in the middle of all this racket from morning till night. I have watched foremen yelling two, three and four word instructions close up into the ears of their people. I know for a fact that foremen and their men, realizing how impossible it is to talk in such a racket, go clear around robin hood's barn avoiding talk in any form. We know that folks in the foundry have just as much talent for gossip as anyone else, including us, and that they are going to use this talent come what may, either in the plant or out.

(*Concluded on page* 214)



ANNOUNCING

3 NEW and improved Aluminum Alloys

—developed and perfected for foundry use in the metallurgical laboratories of William F. Jobbins, Inc.

JOBBINS ALMAG 35 ....*A light alloy replacement for malleable iron*

35,000 to 42,000 tensile, 11.0% to 15.0% elongation, as cast, results with a new aluminum-magnesium alloy, requiring no heat treatment or aging. Has highest shock resistance, machinability and corrosion resistance of any aluminum alloy. *Replaces malleable iron at one-third the weight and with greatly decreased machining* costs. —Bulletin 35-F

JOBBINS 3-6 SUPREME ....*A NEW—more castable aluminum alloy for sand*

Maximum castability in sand comes with an improved aluminum-copper-silicon alloy. High fluidity and low shrinkage minimize foundry scrap. Has high physicals, as-cast, and is heat-treatable to the highest of any non-premium sand cast aluminum. Has excellent impact resistance, endurance limit, pressure tightness. *A one alloy replacement for nearly all sand cast aluminum.* —Bulletin 36-F.

JOBBINS 4-8 SUPREME ...*An improved aluminum alloy for permanent molding.*

A faster casting cycle in permanent molds accompanies freedom from hot-shortness and shrinkage in a new aluminum-copper-silicon composition. Castings have superior pressure tightness and soundness. Physical properties are superior as-cast and can be heat-treated to the highest of any chill-cast aluminum. *High foundry economy and wide customer application result from these properties.* —Bulletin 48-F

Many Gray Iron Parts can be made economically from Jobbins 3-6 or 4-8 Supreme

WILLIAM F. JOBBINS, INC., AURORA, ILL.

PRODUCERS OF PRIMARY & SECONDARY ALUMINUM ALLOYS

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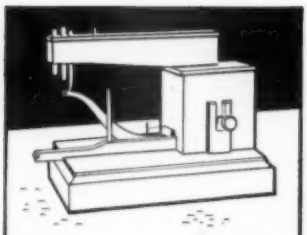
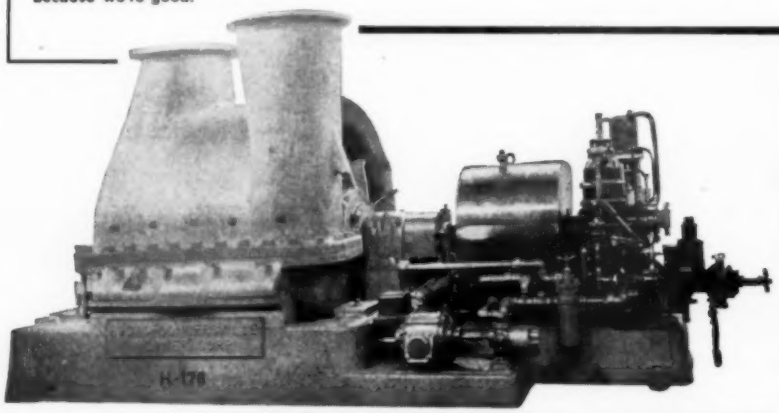


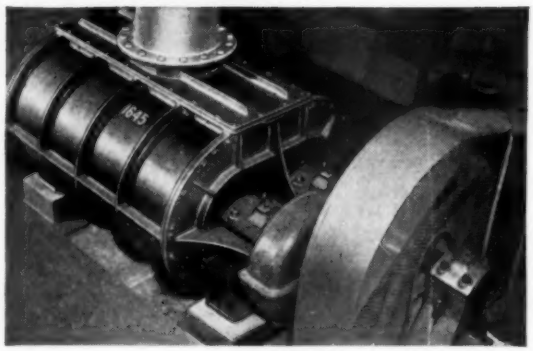
In 1858, Lyman R. Blake invented the original machine for sewing shoe soles to uppers. The first Roots Blower was built four years before that, in 1854. We're not good because we're old, but old because we're good.

YOU CAN COUNT ON

R-C dual-ability

FOR UNBIASED ANSWERS





(Above) R-C Centrifugal, 4-stage Gas Booster in southern steel plant. Steam turbine driven, capacity 11,100 CFM.

(Right) Typical R-C Rotary Positive Blower used for gray iron cupola service.

Our sales engineers don't need to "hedge" on recommendations for blowers, exhausters or gas boosters. That's because of R-C *dual-ability* to supply either Centrifugal or Rotary Positive units. This *dual choice* permits the selection of the right type of equipment to match your specific requirements . . . and it is an exclusive R-C advantage.

Our extensive line of standard units, both Centrifugal and Rotary, meets most needs, without special designs. You can use any modern drive —direct-connected motor, V-belt or steam turbine.

So, for blowers, exhausters or gas boosters, you can count on R-C *dual-ability*. You'll get equal satisfaction from R-C Rotary Positive Meters and Vacuum Pumps and Inert Gas Generators. There's almost a century of blower-building experience at your service.

ROOTS-CONNERSVILLE BLOWER CORPORATION
807 Madison Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE
ROTARY CENTRIFUGAL
BLOWER BUILDERS R-C SINCE 1854
BLOWERS • EXHAUSTERS • BOOSTERS • LIQUID AND VACUUM PUMPS • METERS • INERT GAS GENERATORS

* * ONE OF THE DRESSER INDUSTRIES * *

(Concluded from page 212)

But whether it be in the washroom, over a cup in the refreshment parlor or over the back fence, the shop dope they hear or hand out is bound to be second and third hand as far as headquarters is concerned. We all know what gossip can do to even the best of information.

So far I haven't seen or heard of even the slightest prospects of silent foundry equipment, so it looks as though we're going to have to accept racket as a part of the foundry game for quite some time to come. But I have always heard that there is more than one way of skinning a cat.

Suppose we all agreed that one-sided gossip about our business, about us and about what we are trying to do for the cause was not only unfair but downright wasteful and expensive for everybody concerned. Or, let's put it another way, that two-sided gossip for good was profitable for everybody, so profitable in fact that we can well afford to do something to promote it.

Talk to the Boss

Here's a thought — suppose we made up our minds that by hook or crook we were going to see to it that every employee from the lowliest sweeper on up to the most highly skilled and trained technical man would have a man-to-man personal gab fest with his immediate boss regularly once a month. Obviously the affair would have to take place where a fellow can hear himself think, even if it had to be in the general manager's office.

This would be a personal get-together with no specific axe to grind, just as we might talk over the back fence. It wouldn't be one sided, there'd be no rank messed up in the affair. Both parties would feel free to talk about what was on their minds and in their hearts. Troublesome questions would be dragged out into the open and maybe some steam would be let off with the hope that when the visit was over both parties would be glad it happened.

There can be no question that working out such an arrangement would be a lot of work and trouble. On the other hand I'd be surprised if the investment didn't turn out to be one of the most profitable we ever made. By the way, this isn't just a brain-storm or theory I'm cooking up here—I've seen it tried and seen it work. Maybe a handy place where we could talk to our people regularly would turn out to be a darned good filter in the Foundry Grapevine Telegraph Circuit.

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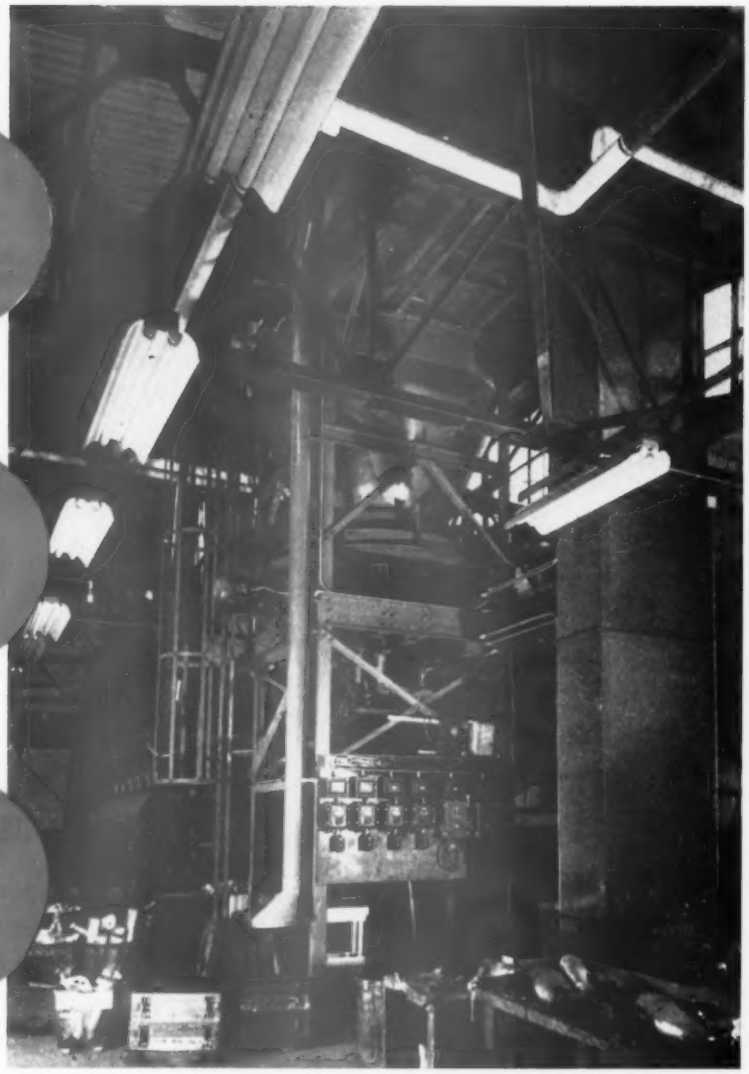

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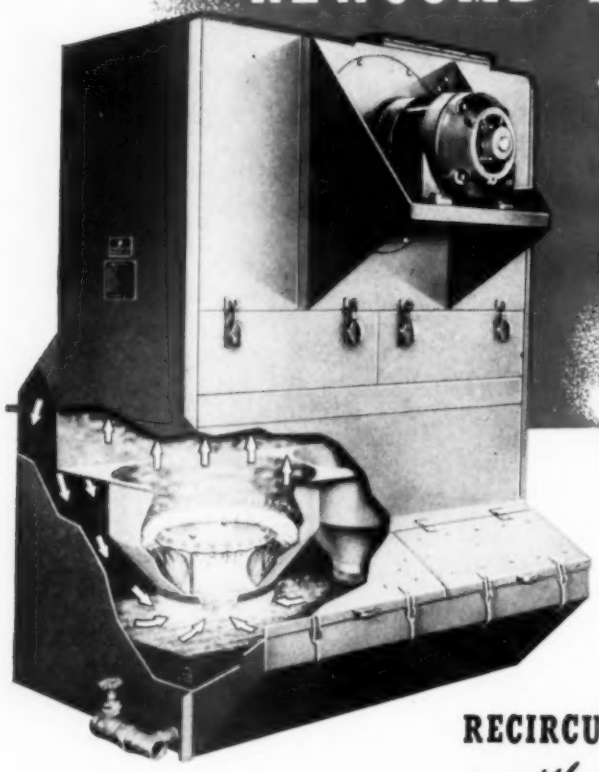

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METALLURGY OF BLACKHEART MALLEABLE

(*Continued from page* 75)

is not a function of the existing composition but of the existing tensile strength; the latter not directly proportional to composition.

This reasoning was transferred to malleable iron on the basis of a comparison of the micro-hardness of its ferrite and of certain synthetic ferrites containing certain concentrations of the elements. A simple treatment was found to be the expression of the effect of each alloy on hardness in terms of an equivalent amount of silicon followed by a graphic representation of ferrite hardness in terms of equivalent silicon. The relative effect of given concentrations of two elements dissolved in ferrite is in a constant ratio within the range of these experiments.

Silicon Is a Weakener

A translation into effect on malleable iron still has an imperfection, for since statistically there is no doubt that silicon is a weakener, we are confronted with a strengthening effect in ferrite. This is very probably due to an increase of sprawliness of graphite. It might be that a study of the effect of silicon on the tensile strength of whiteheart malleable in which apparently graphite is always spherulitic, would throw further light on this reasoning. There are those who have thought that silicon could be present in malleable as the element, an idea for which the writer has seen no evidence.

An unsolved mystery is how hydrogen can affect the properties of malleable. The hydrogen content of all malleable iron is practically the same, having come to equilibrium in the annealing process. The mechanical properties of the product seem to bear some systematic relation to the hydrogen content of the hard iron. Attempts have been made to explain the effects of various elements on the properties of ferrite in terms of atomic sizes or configuration with entirely negative results.

As a practical matter there is little importance to be attached to elements other than carbon, as far as engineering properties are concerned. Few subjects, however, have so interested the experimentor as their influence on graphitizing rate.

The mechanism of first-stage graphitization—that is, above the critical point—seems to be quite well

(*Continued on page* 218)

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(*Continued from page* 216)

established. Details may require further study. It can be said with considerable certainty that graphitizing rate is always determined in the beginning either by the linear crystallization velocity of graphite or the rate of solution of cementite. The former is the usual condition but there is evidence which can be interpreted as a retardation of cementite solution by the presence of the sulphide films first reported by Levy. After but little graphite formation the determining factor as to reaction rate is the migratory rate of carbon in austenite. To a limited extent, when graphitization is nearly complete, the rate of decomposition of the carbide governs.

Largely because it is no longer usual to begin graphitization below the critical point, less attention has been given to the initiation of graphitization at such temperatures. Above A_1 the conditions have been expressed in the form of equations. These are somewhat complicated and, incidentally, represent about 1500 man-hours of desk work in their derivation and checking.

The mechanism by which graphitization is completed with liberation of ferrite is of enormous industrial importance. A major handicap in its theoretical elucidation long lay in the lack of appreciation of the fact that it actually occurs in two stages. One is a very rapid one, occurring between the A_1 stable and A_1 metastable temperatures and involving the conversion of austenite into graphite and ferrite. This process may perhaps be so fast as to make its stepwise study difficult. It is about ten times as fast as is the reaction just above this range and about one hundred times as fast as that just below it. Given even a reasonable cooling rate, graphitization can be entirely completed by the time the temperature falls below the metastable critical point.

If this procedure is adopted, there is no need for information as to completion of the reaction at lower temperatures. If not, the problem lacks specificness, unless we consider the sudden cooling of an alloy in equilibrium above the critical range to a temperature below that range. This condition has practical application mainly in the making of pearlitic malleable. In this special case the problem could, perhaps, be approached very much by the same principles used in studying primary graphitization above the critical range.

One of the numerical constants in the graphitizing rate equations is the number of nodules per unit volume. Be it noted in passing that although there is a general relation between the number per unit area and unit volume, the latter is the characteristic figure. In the field of what determines this number there is still much to be learned. Morrogh teaches that graphite crystallizes on sulphide inclusions. Admittedly this is frequently so but it is certainly not true that the number of nodules equals the number of such inclusions. White cast iron quenched from say 1000° C and then graphitized, has many hundred, or even several thousand times as many nodules per unit volume as when graphitized without prequenching. There is no reason for believing that the preliminary treatment alters the number of sulphide inclusions. Furthermore, many sulphide inclusions are found about which no graphite grew, and on the other hand there are graphite inclusions in which one can see no sulphides. The latter may, perhaps, be an oversight in that the microscopic plane does not pass through the small sulphide in the larger graphite nodules.

STUDENT FOUNDRYMAN: Charles W. Keith, second-year student in the College of Engineering at Ohio State University, Columbus, O., is shown applying the squeeze pressure on a jar-squeeze-pin lift machine. This machine is one of several recently donated to Ohio State University's foundry laboratory by the Tabor Mfg. Co., Philadelphia, in an effort to help fill the demand for young men with foundry training. Mr. Keith is a member of the university's student chapter of the American Foundrymen's Association

Consider Many Factors

It has been shown that graphite nodules first form, certainly preferentially, and perhaps always, at cementite-austenite interfaces, and the area of this interface is increased by precipitation, during reheating, of cementite particles from martensite produced in quenching. It appears that the formation of martensite is necessary to make the process effective. Sulphide and other inclusions have some tendency to precipitate on this same interface. Since all of the enumerated determining factors for the beginning of graphite growth represent areas of high energy state, it may perhaps be true that these states themselves are the determining factors in the initiation of nucleization.

The form in which temper carbon occurs has already been referred to frequently as of major consequence. Having no contact with irons containing iron sulphide, we, in America, first learned of the existence of the dense spherulitic type of nodule from British publications and by the examination of samples of British origin. We did know that when temper carbon is formed, and grows at high

(*Continued on page* 220)

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(*Continued from page* 218)

temperature, the number of nodules is greater and they are more sprawly than if graphitization takes place at lower temperatures. We have also demonstrated that temper carbon initiated and growing below the A_1 point, is in quite spherical masses, which, however, are not as dense and have not the high order of crystallinity of the spherulitic inclusions in your whiteheart malleable. Furthermore, it is known that the addition of tellurium promotes the formation of dense temper carbon which is not spherulitic, although approximately equiaxed.

Graphitization is, in large measure, influenced by the composition of the hard iron. We know that with the exception of vanadium whose carbon compound (or iron carbon compound) is stable at all temperatures, the effect of alloys is much more marked below the critical point than above. Palmer has recently substantiated this point. There is little completely convincing knowledge as to the mechanism by which composition alters graphitizing rate, when it does not, as in the case just mentioned for vanadium, merely introduce a corresponding amount of a stable phase.

Silicon, nickel and manganese (except as sulphide) and chromium, are in considerable part contained in the carbide phase, and molybdenum entirely so. Copper could not be studied by the techniques used. Further investigation is lacking but it appears likely from the general character of x-ray spectra that these elements merely substitute atom for atom, for iron, and do not form new compounds. Indeed there is evidence that at temperatures above A_1 cementite is no longer Fe_3C but first becomes richer in carbon, approximating Fe_3C, and then poorer. The type of crystal lattice is unaltered and the lattice is apparently stable irrespective of the exact number of carbon atoms which it contains.

Explain Experimental Observations

Many years ago Levy reported the formation of iron sulphide films in and around cementite particles. The pictures were not completely convincing and your speaker has never found an observer who claims to have seen these structures. Nevertheless the presence or absence of allotriomorphic sulphide films would explain many things. A sulphide phase separating from the alloy during freezing, while the sulphide is liquid, will produce an allotriomorphic film of the sulphur compound. If the freezing point of the sulphide complex is above that of the parent metal it will separate as a liquid drop or as a crystal and be present ideomorphically. The presence or absence of allotriomorphic sulphides will, however, explain many experimental observations.

We lack much data regarding free energies of formation but it is fairly reasonable to suppose that the stability of the sulphides is in the following order: Iron, manganese, tin, cerium and lanthanum. It is also reasonably certain that the melting point of iron and tin sulphides are below that of the iron and the others above. If iron sulphide is present, graphitization is retarded (allotriomorphic phase). If manganese is added, graphitization goes on (ideomorphic stable MnS). If tin is now added, graphitization is retarded (the still more stable tin sulphide is allotriomorphic). Adding a rare earth restores graphitization (ideomorphic stable sulphide).

Selenium and tellurium are, to some extent, equivalent to sulphur. Many graphitization accelerators—silicon, aluminum, zirconium and titanium—are also deoxidizers, and un-

(*Continued on page* 222)

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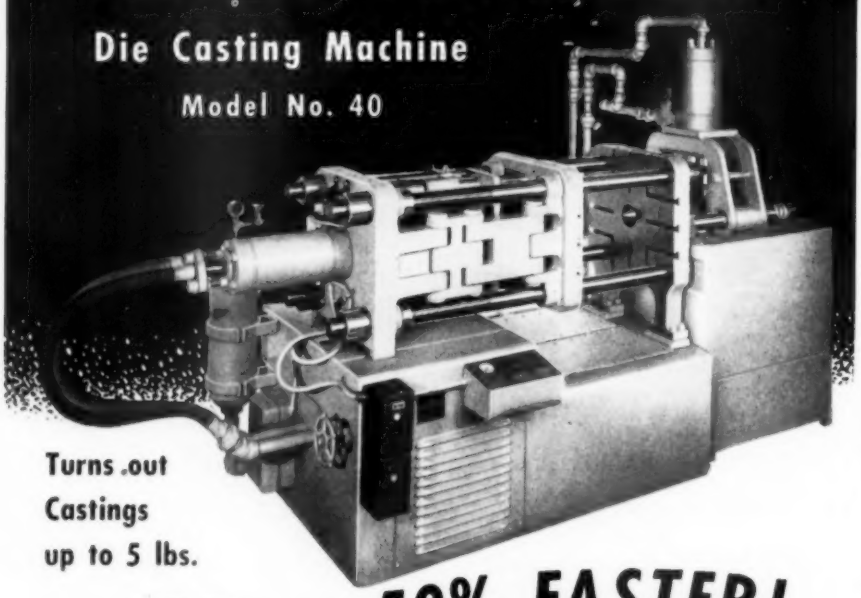

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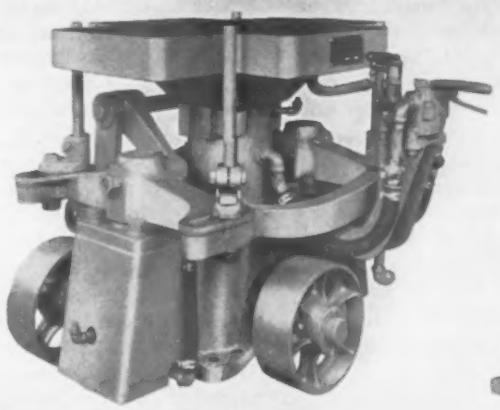

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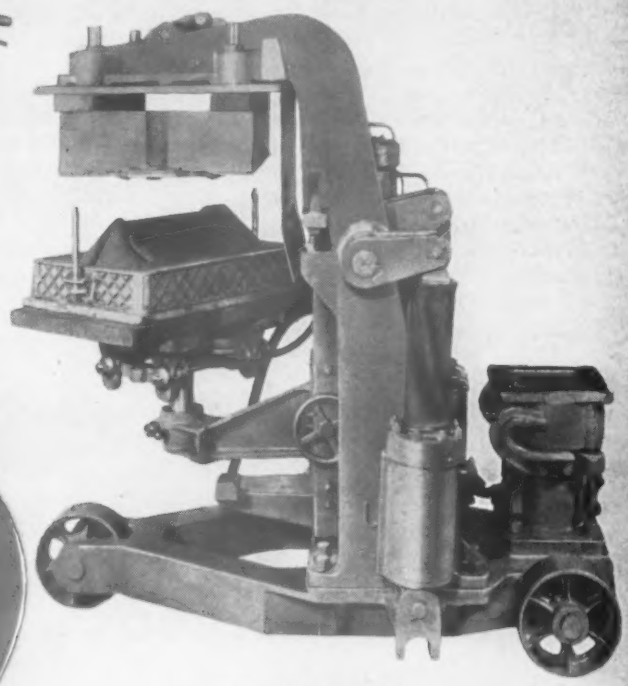

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(*Continued from page* 220)

til experiments are made with completely deoxidized metal it may be argued that it is absence of oxygen rather than presence of these elements that produces the result.

The argument would appear to be invalid in the case of silicon, the only one of the series whose effect is known as a function of concentration. The graphitizing rate is multiplied equally by equal increments of silicon throughout the entire useful range, which is scarcely compatible with a deoxidization theory. Nickel and copper are fairly good accelerators and can scarcely be thought of as deoxidizers. Aluminum, zirconium and titanium are potent in extremely minute concentrations of the order of a few hundredths of 1 per cent, which makes the mystery all the greater. Nucleization, possibly by the oxides of these metals, is suspected but preliminary surveys seem to show that acceleration is produced without marked increase in nodule number.

The retarding effect of chromium, manganese or molybdenum could be ascribed to a stabilizing effect on the iron carbide were it not for the fact that graphitization appears still to be controlled in rate by the migratory rate of carbon. Perhaps ultimately the atomic physicists will be able to tell us of a mechanism by which these elements, which are prone to combine with carbon, should also retard its migration.

Retardization of graphitizing by hydrogen is known to be accompanied by some decrease in nodule number, but also the rate of growth of nodules is retarded. There remain the alternatives of a decrease in the migratory rate of carbon through the gamma lattice containing interstitial hydrogen atoms, or a decrease in surface per unit volume. The known acceleration by carbon of hydrogen diffusion in low carbon steels does not appear to suggest a retardation of carbon diffusion by hydrogen.

Boron Speeds Graphitization

The element boron is of peculiar interest. In concentrations of a few thousandths of 1 per cent it greatly accelerates graphitization without any initial marked effect upon nodule number. Above some 0.003 per cent the nodule number begins to increase suddenly and enormously. The effect on graphitizing rate decreases in intensity but is still marked in the region of 0.10 per cent, although with marked deterioration of quality. Concentrations of 1 per cent or so completely inhibit graphitization and, strangely enough, white cast irons of conventional composition to which such amounts of boron are added have the metallographic appearance of a hypereutectic iron-iron carbon alloy. For scientific reasons an exploration of the x-ray spectroscopy of the boron-carbon iron alloys should be undertaken, although there is no particular practical need for such knowledge.

Primary graphitization during freezing is, of course, to be shunned like the plague. Laplanche has lately greatly improved our knowledge of the carbon-silicon ratios necessary to control this factor. He greatly systematized our understanding and interpretation of earlier American observations, and has, it is to be hoped, disposed for good of the fallacious diagram of Maurer which had been ignored by malleable metallurgists because of its evident lack of utility. Other elements than silicon which are normally present in blackheart malleable seemed to have little effct on primary graphitization, although this is not true of the active graphitization promoters such as aluminum. Incidentally, alloys contain-

(*Continued on page* 224)

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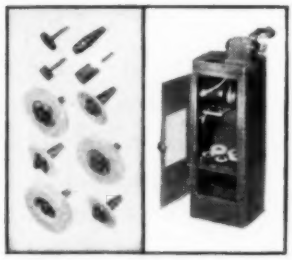

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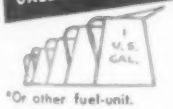

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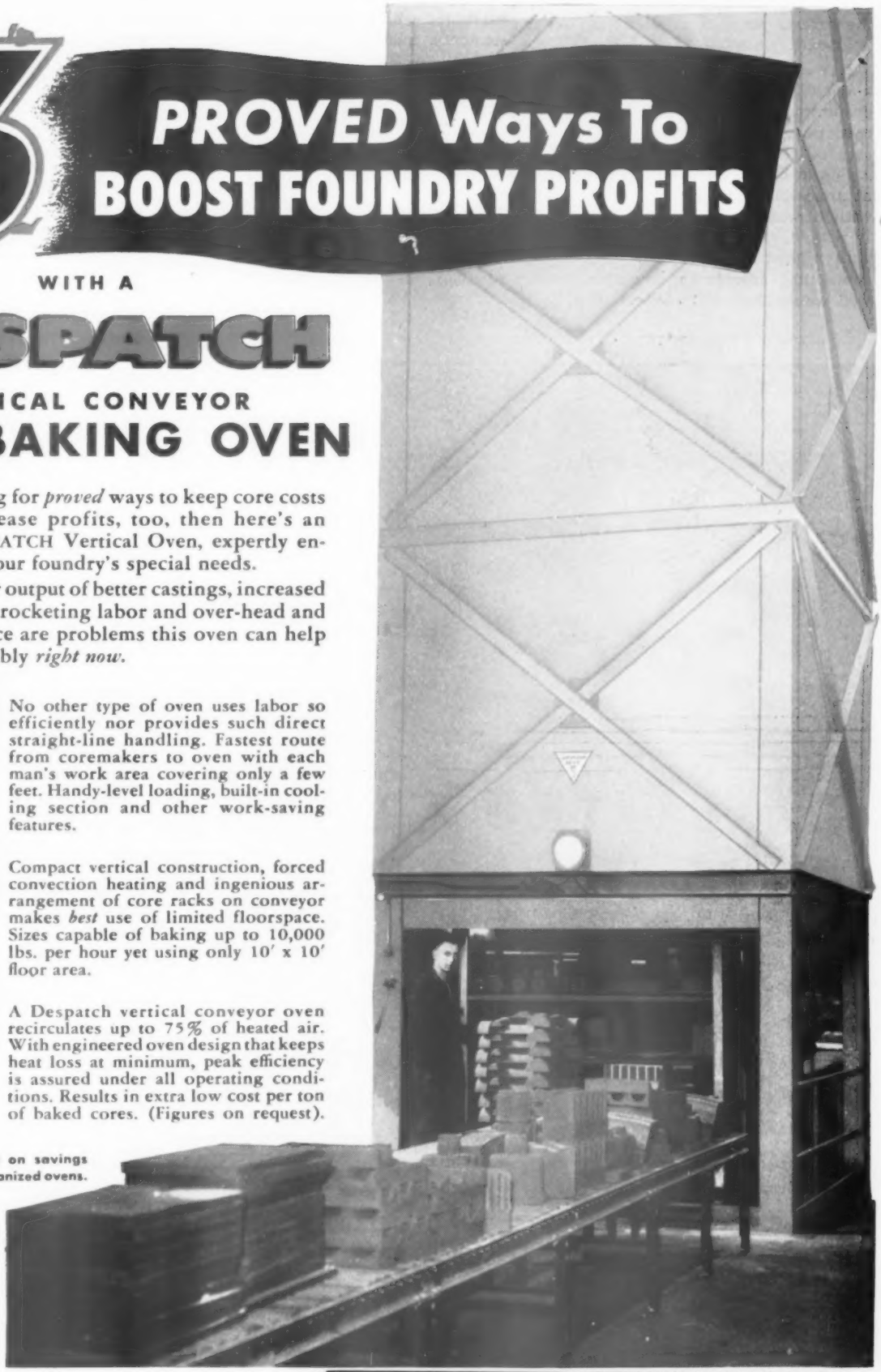

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(*Continued from page* 222)

ing several per cent of aluminum are ungraphitizable.

It may occasion surprise that the ambient gases can greatly alter the graphitizing rate of a given white cast iron. Taking the graphitizing rate *in vacuo* as standard, graphitization in hydrogen, or in gases which at annealing temperatures, dissociate with liberation of hydrogen, definitely retard graphitization. The facts with regard to atmospheres initially containing anhydrous ammonia are well established and observations on hydrocarbons, such as acetylene for example, which dissociate into the elements, indicate a similar trend.

Nitrogen and argon, and presumably also the other inert gases, behave like a vacuum, but mixtures of CO_2 and CO, though not either gas alone, promote graphitization. Honda and Murakami suggested in a British publication that all graphitization took place by the alternate oxidation of the carbon of cementite by carbon dioxide and the deposition of graphite from the resulting carbon monoxide with resulting reformation of the higher oxide. The ability to graphitize in the absence of oxygen speaks against this hypothesis.

A very pure iron carbon alloy containing about ¾ of 1 per cent of combined carbon, when heated at a temperature a little below A_1 for some three months in pure argon at approximately atmospheric pressure, lost a major part of its carbon. A metallic gray powder found in the tube, which may very well have been graphite, was unfortunately not identified as such either chemically or by x-ray spectrograph. There seems here to be clear evidence that the free energy of graphite not embodied in ferrite, is less than the free energy of that substance *in situ* in iron. An effect of pressure of the metal on included graphite may be suspected.

Explanation Difficult

It has been noted that an increase in pressure on a CO-CO_2 atmosphere, which should favor the decomposition of carbon monoxide into carbon dioxide and carbon has been observed to accelerate graphitization above the critical point, but in the case of the particular gas compositions used, a pressure of a few atmospheres completely supressed subcritical graphitization. It is quite difficult to suggest an explanation. Even if, at high pressures, the lines marking equilibria of CO-CO_2 mixtures with graphite and cementite respectively, as a function of temperature, intersect in the region of 700° C, there still remains the question of how a pressure on the outside of a piece of metal has an effect near the center of the ⅞-in. diameter specimens on which the observations were made. The question received some light from the fact reported by the investigator that graphitizing appeared to be inhibited more in the "second stage" near the surface of the casting than near the center.

The effect of the surrounding gas upon decarburization and the producing of low carbon rims which graphitize with difficulty, is another matter. The formation of decarburized rims is desirable, especially in high carbon iron, from the viewpoint of increasing elongation. Deterioration of graphitization is, of course, objectionable.

The subject has been studied somewhat thoroughly only where the carbon is removed by oxidation. Removal by hydrogen is also possible; it having been shown that at as low temperature as 200° C hydrogen purified by bubbling through the liquid alloy of sodium and potassium, removed carbon readily from white cast

(*Continued on page* 226)

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(*Continued from page* 224)

iron. The particular hydrocarbon formed was not identified but was presumably methane. The work of various investigators with regard to the equilibrium constants of the reaction between carbon, as such, or as cementite, hydrogen and methane, suggests that decarburization is possible at temperatures where the hydrocarbon is fairly unstable. Since the use of hydrogen would, of itself, retard graphitization, the reaction with this gas has been of less interest than that with CO-CO_2 mixtures in a variety of combinations.

In this field you, in Britain, who wish to produce decarburized castings without scaling, have made more progress than we have in America. We have done little on the matter of rate of carbon removal, and if I understand the published work, then you have been in a position to conclude that primarily a diffusion of carbon in iron is involved. This seems to be true with the limited degrees of decarburization in which we have been interested.

We were quite surprised to find in our own work that ferrite rims could be formed at temperatures above the A_1 point of the parent alloy. Further investigation showed that they did not form above the A_3 point of the alloy in its decarburized state. We were earlier aware that carbon would not migrate from a high carbon iron into approximately pure ferrite at temperatures below the latter's A_3 point. It would now seem that, within the depths of ferritic rims with which blackheart practice concerns itself, say from 0.01-in. to 0.10-in., the migration rate of carbon in alpha iron must be enormously rapid as compared with its migration in gamma iron in order that carbon may have migrated through this zone to the exterior under an extremely small gradient. Comparing this with the experiment mentioned just before, it may be that the diffusion into ferrite below its A_3 point was so fast as to produce very wide zones in which decarburization was at so low a concentration as to escape microscopic detection.

Tendency To Absorb Oxygen

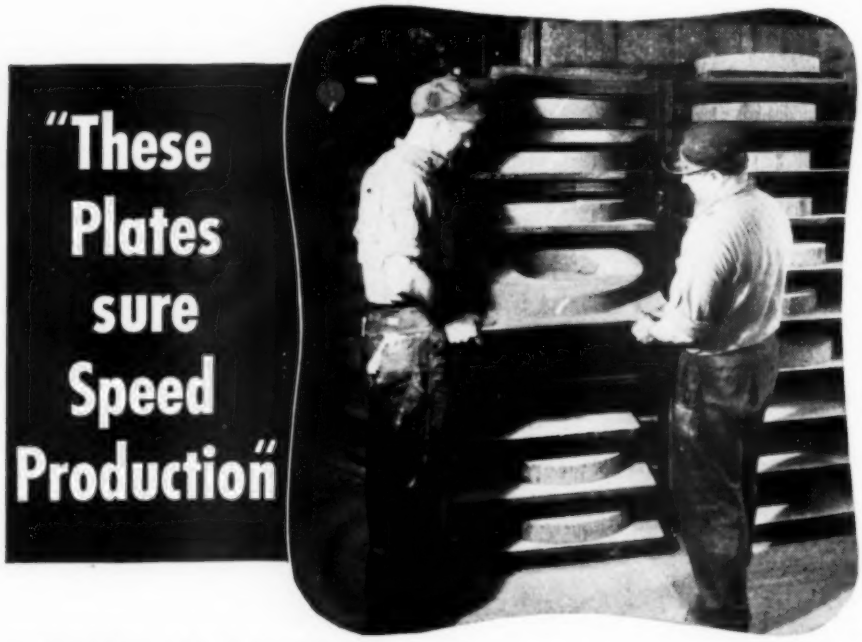
For a considerable time it seemed that in the presence of ferrous oxide, under conditions which should insure the formation of an atmosphere in equilibrium therewith, the commercial white irons still oxidized, converting iron into one of its oxides. This anomoly was, however, traced to the great tendency of ferrous oxide to absorb oxygen at room temperature. Precautions to assure the absence of higher oxides resolved the difficulty.

It now appears that the silicon, manganese and other elements present in normal practice do not, at least to any great extent, alter the equilibria between CO, CO_2, Fe and FeO. These equilibria, including those involving the presence of carbon as cementite, have as you know, been long and thoroughly investigated and the writer's present thought is that there is little need to carry that portion of the work over into investigations of the impure alloys of commerce.

Oxidation of silicon in silicon steels has been the subject of study and similar experimentation is being carried forward on white cast iron. It appears that any conditions which result in the formation of ferrite rims are likely to result also in the formation of a layer called "subscale" by some workers. This is a layer which contains silicon dioxide or perhaps a silicate partly as a cloud of particles in the ferrite and partly on the grain boundaries.

Carbon will not migrate into this

(*Continued on page* 228)



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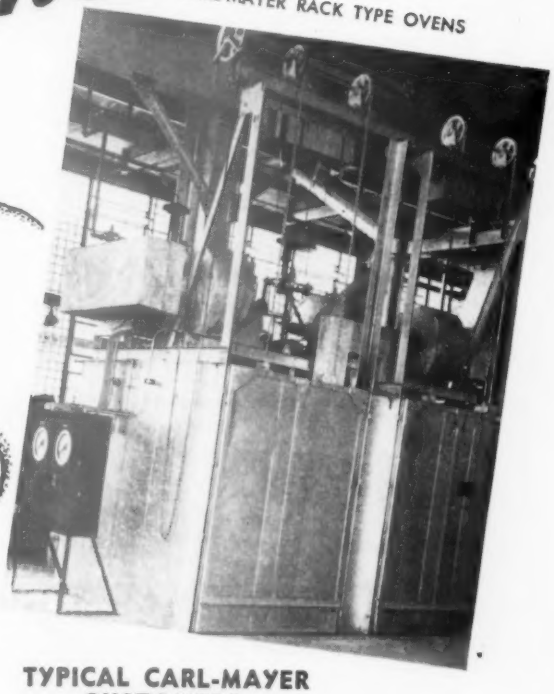

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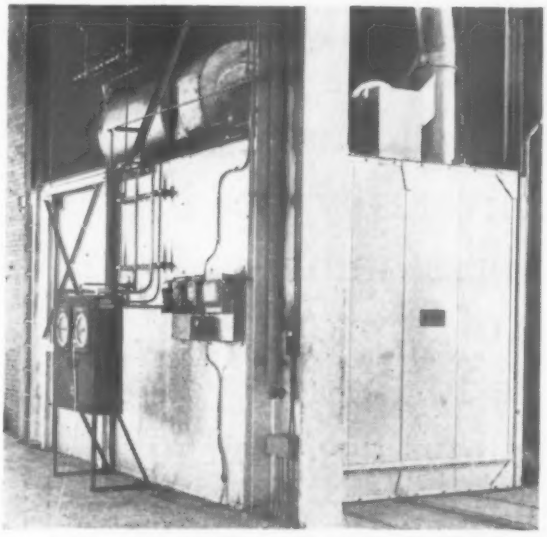

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(*Continued from page* 226)

subscale at temperatures at which it migrates into what was the ferrite zone. At least one worker has put forward as an explanation the blocking of migratory paths by these inclusions. The idea warrants further attention even though grain boundaries parallel to the surface seem to have perhaps less inclusions than those perpendicular to the surface.

The formation of subscale requires the presence of silicon. If silicon is present, then under given constant conditions the thickness of the scale increases as the square of the time, but in iron differing in silicon content at a given temperature and with a given gas phase the subscale thickness varies inversely as the silicon content, suggesting an exhaustion of the gas activity by reaction with that element. All white cast irons contain sonims, which at least after ignition to remove carbon, are complexes of Fe_2O_3, Mn_3O_4, P_2O_5 and SiO_2.

After annealing, the amount of sonims may be nearly tripled without much increase in the concentration therein of Fe_2O_3. The concentration of Mn_3O_4 largely increases, P_2O_5 disappears and the SiO_2 decreases in concentration. The total SiO_2 per unit weight of iron remains nearly constant but the observations can, in the speaker's judgment, best be interpreted as a slight decrease in the total amount of that element. Note that this is true despite the formation of additional SiO_2 in the rim. Therefore, apparently SiO_2 in the body of the casting may disappear.

Attempts to identify the particular chemical compounds existing in the sonims proved fruitless since x-ray spectra did not agree with any known compounds containing the elements in question.

There is a great increase in interest in our country in the so-called pearlitic malleable. The name is a misnomer, adopted over this speaker's personal protest. These irons contain combined carbon but not necessarily as pearlite.

Three Distinct Types

Three quite distinct types of metallography are desired for differing purposes. The first consists of temper carbon surrounded, as the petals surround the heart of a daisy, by ferrite crystals, all embedded in a matrix of laminated pearlite. The second consists of temper carbon embedded in a matrix of ferrite throughout which spheroids of cementite are uniformly scattered. The matrix structure is that sometimes designated as "spheroidite." The third structure is that of malleable iron, with a network of finely divided carbides located on the ferrite grain boundaries.

The interest at this point is in the attainment of the desired distribution of constituents. The first structure, the so-called "bull's eye" malleable, is formed in the interval between the stable and metastable A_1 point by the direct conversion of austenite into ferrite and temper carbon. The cooling rate must be such that the reaction is complete in the required degree. The structure can be obtained in normal malleable iron with somewhat accelerated cooling but the result is more controllable in the presence of retarding elements, especially manganese. During the graphitizing process, in this temperature range, ferrite and graphite appear simultaneously. Crystallization is initiated at an existing graphite surface and the ferrite takes an adjacent position and makes the petals of the bull's eye flower.

If ordinary malleable iron is reheated to a temperature of say 850° C for a moderate time, equilibrium appears to be reached with the formation of a saturated solution of car-

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bon in gamma iron. This writer happens to think that this solution may not be identical with austenite of the same carbon concentration. If the metal is then cooled at the rate which would be supposed to give bull's eye structures, failure is almost certain to occur. A random pattern of ferrite and pearlite results. If, however, the heating at 850° C is greatly prolonged, bull's eyes occur at a suitable cooling rate.

The explanation appears to be that whereas white cast iron contains no ferrite when cooling through the critical range begins, a reheated malleable still contains vestiges of ferrite which initiate graphitization by serving as nuclei for the deposition of alpha iron during the cooling process, giving the resulting iron their own random distribution. If one wishes the spheroidized matrix, it is quite important to avoid much separation of ferrite during cooling so as to arrive below A_1 metastable, with a finely laminated, or even martensitic structure. A further spheroidizing treatment analogous to that for tool steels is then applied. It may be necessary, if graphitization during spheroidization is to be avoided, to consider a retardation of the former by suitable alloying.

Ferrite First Appears

These considerations lead to some comment as to the conditions under which the ferrite first appears by decomposition of martensite. A white cast iron was quenched after attainment of stable equilibrium at 975° C and then held at various temperatures (below A_1 metastable, 770° C) for three hours. At 740° C faint traces of grain boundary ferrite were seen, which became more pronounced in material held at 733° C. At 728° C there was formation of both grain boundary and bull's eye ferrite. At 725° C the formation of bull's eye ferrite predominates and at 720° C graphitization is sufficiently complete in 8 hours so that only patches of what is probably spheroidized pearlite remain, giving no clue to any ferrite pattern.

Instead of being completely ferritic on holding at any lower temperature, the metal begins to show a general random distribution of large areas of spheroidite when held at 682° C. This is obviously a manifestation of the retardation of graphitization by the low temperature which still permitted spheroidization to proceed.

The temperatures here given do not check too well with the A_1 critical range. It is possible that this is due to difference in thermal lag. The manufacture of the pearlitic malleable containing networks of, shall we say, fine pearlite, is an application of a very interesting phenomenon observed many years before a praetical application was made. When an annealed blackheart malleable is heated into the region of the A_1 transformation, carbon first dissolves along ferrite grain boundaries. Within a rather narrow temperature range, at each specific temperature, recombination occurs only along a band of definite width. This width is apparently not a function of time after the first brief interval. Mainly the alpha-gamma transformation on heating occurs at a lower temperature for the grain boundary metal than for the body of the ferrite crystal.

One explanation which has been offered is that carbon is more easily taken into the disordered ferrite lattice near the grain boundary than into the regular lattice further in. A hypothesis based on rejections of alloy to ferrite grains would be attractive but is inadequate, for the diffusion of alloying elements other than carbon, is an extraordinary slow process and can scarcely be expected

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to occur at temperatures where ferrite grains form *ab initio*.

That the dendritic segregation of such elements as silicon, manganese and phosphorus is not overcome by the annealing heat treatment is shown by the fact that cautious etching in alkaline picrate solutions of high boiling point reproduces in a malleable iron, the original as-cast structure. A study of structures, so developed, indicates that to a considerable extent ferrite grain boundaries run, when possible, through areas that were cementitic in the hard iron. Further, the recombination of carbon seems easiest; that is, gamma transformation occurs at the lowest temperatures at boundaries so located.

It is known that, during freezing, cementite is enriched in silicon and manganese. The former raises the critical point; the latter lowers it. Apparently, therefore, the segregation of manganese is the dominating factor. Our knowledge is, however, again incomplete, for the width of the recarburized bands at the grain boundaries seems less than that of the cementite masses, which again brings us back to atomic disorder.

Near the beginning of the discussion of pearlitic malleable the speaker risked some criticism by hazarding the opinion that the stable and metastable solid solutions of carbon in iron differ otherwise than in concentrations. The evidence may not be completely convincing. The most important point is that during the process of graphitization the electrical resistance of the material falls, reaching minimum at the point where cementite disappears, and then again rises.

The experiments were made under conditions which did not involve the possible reduction in size of the specimens by oxidation. Also, attempts have been made to photograph the gamma iron x-ray spectra of the stable and metastable solid solutions at high temperatures. The interatomic distance of gamma iron, in which carbon is in stable equilibrium, is practically identical with that of pure iron.

The corresponding interatomic distance in metastable equilibrium is greater than that of pure iron, corresponding to that of austenite of a given carbon concentration. This investigation was not carried on in the writer's laboratory or under his supervision but was executed at one of America's leading technical schools. The investigator, a faculty member of that school, was convinced of the accuracy of his observations and so far as this speaker can judge, his results are entitled to respect.

Explanations Unsatisfactory

The last item requiring attention is the subject of intergranular brittleness. It was long known that much blackheart malleable, when galvanized, became brittle and broke with a white fracture. Explanations were sought in a possible recombination of carbon due to overheating in galvanizing or in hydrogen embrittlement due to pickling. Neither explanation could be justified. It was finally recognized that embrittlement occurred because of a fairly long sojourn near 475° C and could be prevented by previous quenching from about 650° C or cured by very long holds near 200° C.

It was also found that the presence of certain minimum concentrations of silicon and/or phosphorus were necessary to produce the phenomena. Note here an analogy to low-temperature impact strength which can be improved by a 650° C quench but only if the same two elements are not present in too large amount.

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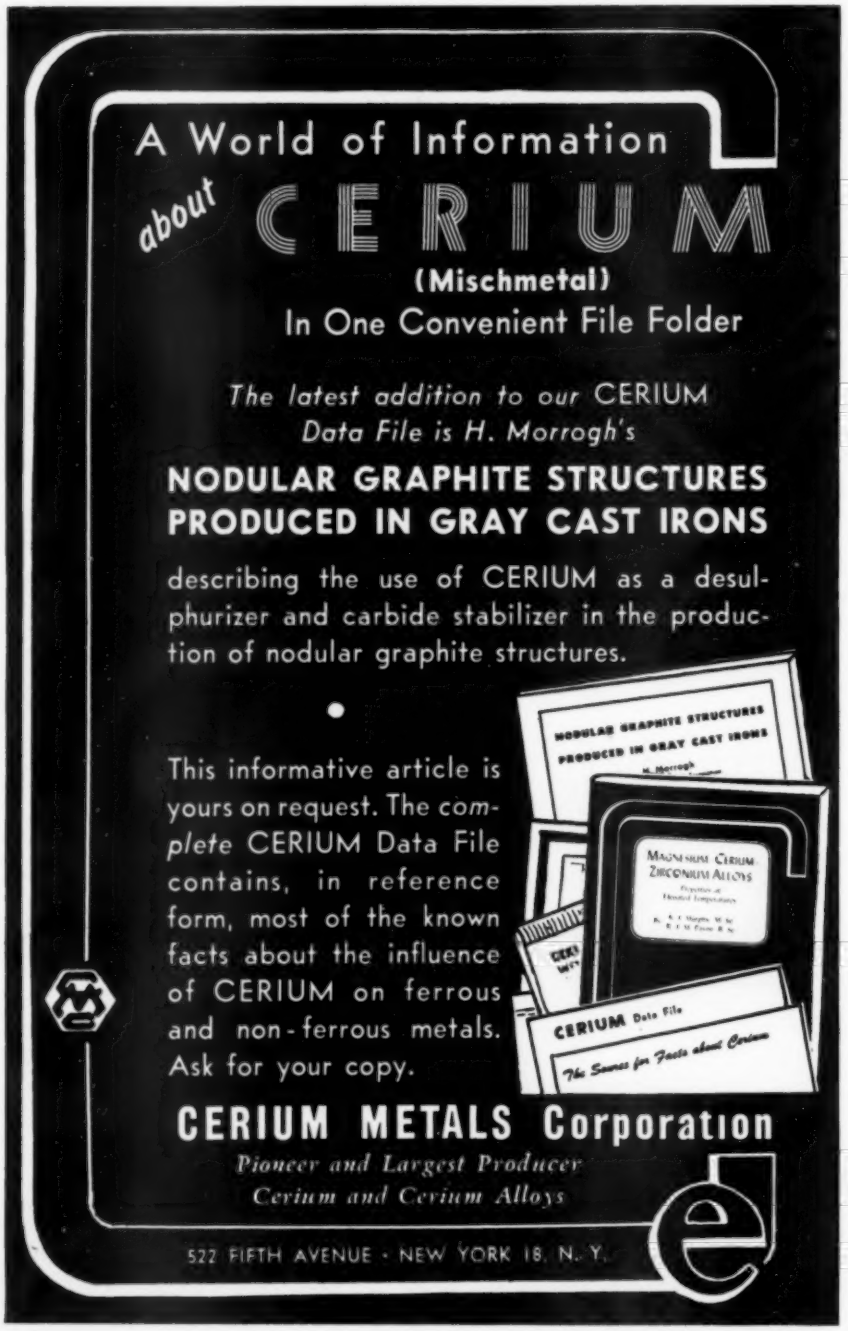
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(*Continued from page* 230)

The current suggestion is that the embrittlement is due to the separation of a grain boundary constituent. A carbide and a nitride have been suggested. The explanation seems weak. No such compounds can be seen. It is not easy to imagine a cure by low temperature heating and the demonstrable effect of silicon and phosphorus does not enter into the explanation. This is one of the unsolved problems, even though, from an operating viewpoint, our knowledge suffices. A similar instance where satisfactory operating knowledge exists without proper scientific basis is that the graphitizing rate of white cast iron decreases with the basicity of the refractory in which it is melted.

In preparing the present address it has seemed wise to adopt a rather strict limitation of metallurgical principles. Obviously our subject could be much expanded in the direction of equilibria in melting furnaces, heat transfer problems and many other engineering fields. These fields are, however, almost never limited to the malleable industry alone and an extension of our interest along these lines would produce a paper dealing not with its present subject but with foundry engineering in general.

In conclusion I can only express to you, to your officers and to your council, my sincere thanks for the opportunity and honor of preparing the present paper.

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(*Continued on page* 234)

General view showing two ovens served by conveyors; these Gas-fired ovens were installed right in the production-line for continuous drying of painted material.

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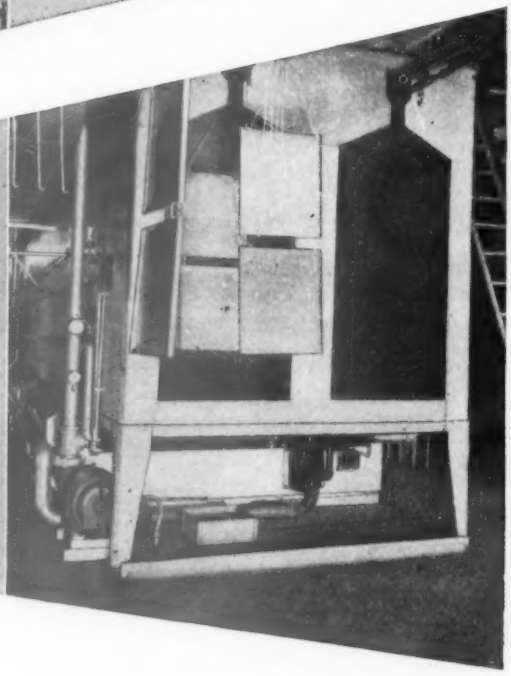

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(*Continued on page* 236)

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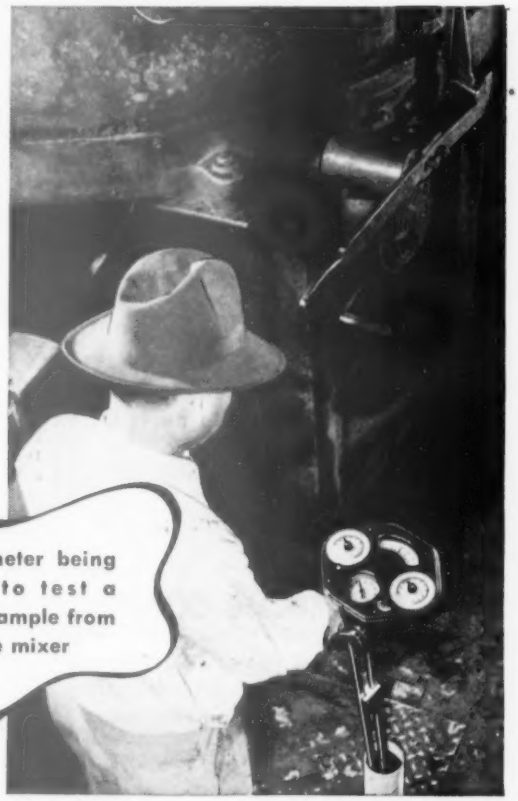
Moistmeter testing moisture of sand on the foundry floor.



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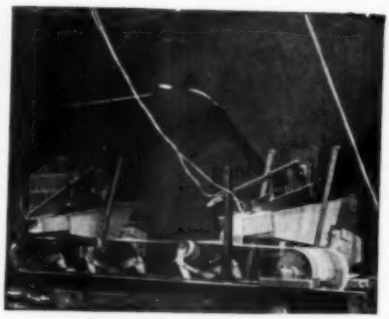

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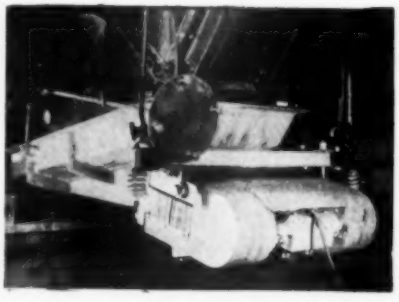

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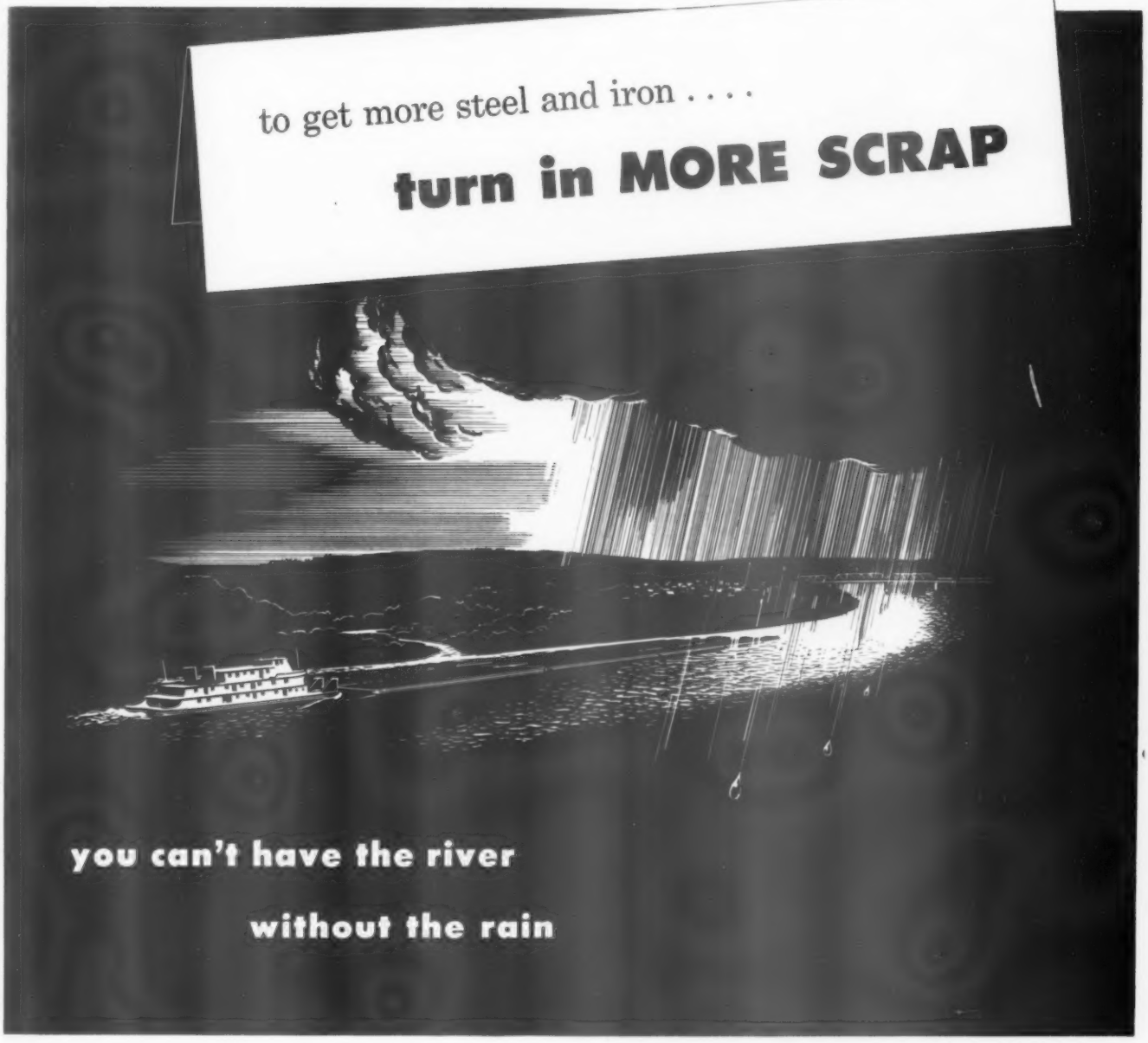

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without the rain

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On the farm, around the factory, along the highway, or anywhere, every ton of scrap that can be found is badly needed, and a ready and profitable market is waiting for all of it. Now is the "cleanup" season when most of such material should be turned in to channels that lead to the mills and foundries; and whatever is done to move it is a contribution to the general good.

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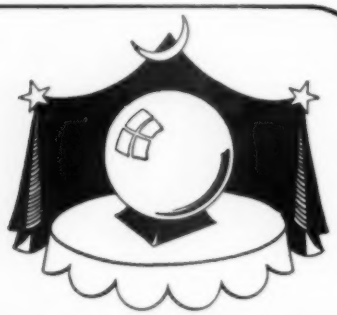

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CASTING SOIL PIPE CENTRIFUGALLY

(*Continued rfom page* 91)

perature, iron composition, mold temperature, physical properties of coating, wall thickness of pipe, weight of pipe, Shore hardness, and quantity of the hub core. The process has not been found to require exacting control on such things as iron temperature, but we have found that it is advantageous to stay within established limits on all important factors to insure a good quality product at the lowest cost.

Physical Properties—Physical properties of soil pipe produced by this process are well within all of the specifications for the product. As a matter of interest the average physical properties and range in chemical analysis of pipe made by both this process and the conventional static sand cast process are listed in the accompanying table. These test data show that the product made by this process is comparable to sand cast pipe, and that it has physical prop-

COMPARATIVE PROPERTIES

Test	4-in. Static Sand Cast	4-in. Centrifugally Cast
Average wall thickness	0.24-in.	0.26-in.
Wall thickness variation	0.073-in.	0.036-in.
Bursting pressure	2,100 lb	2,220 lb
Bursting tensile strength	16,270 psi	22,000 psi
Ring Crushing		
Modulus rupture	67,033 psi	61,000 psi
Modulus elasticity	18,400,000 psi	14,700,000 psi
Talbot Strip		
Modulus rupture	58,406 psi	50,200 psi
Modulus elasticity	11,200,000 psi	12,300,000 psi
Rockwell "B" Hardness	84-92	82-96
Chemical Composition		
Total carbon		3.40-3.60%
Silicon		1.90-2.20
Phosphorus		0.90 max
Manganese		0.50-0.60
Sulphur		0.110 max

erties equal to that of pressure pipe.

Central Foundry Co. has been making pipe by this process for over two years. During this time more than 2 million 5-ft lengths of pipe have been made by the centrifugal method described here. In addition to increasing our production, the new method has served to better the morale of our employees by improving working conditions and making our foundry a more desirable place in which to work.

This paper was presented before the annual Foundry Practice Conference of the Birmingham Chapter, AFA, Feb. 13.

IFMA Holds 18th Annual Meeting

Industrial Furnace Manufacturers Association Inc. elected C. H. Stevenson, Lindberg Engineering Co., Chicago, president and chairman of the board of directors, at the eighteenth annual meeting, held at Hot Springs, Va., in May. Mr. Stevenson succeeds William Adam Jr., Ajax Electric Co. Inc., Philadelphia.

J. J. Walker, C. I. Hayes Inc., Providence, R. I.; J. Earl Frazier, Frazier-Simplex Inc., Washington, Pa.; F. W. Brooke, Swindell-Dressler Corp., Pittsburgh; and D. A. Campbell, Bryant Heater Co., Cleveland, were elected directors for a term of two years. William Adam Jr.; R. T. Cadwell, Holcroft & Co., Detroit; W. E. Borbonus, R-S Products Corp., Philadelphia, and S. W. Fletcher, J. O. Ross Engineering Corp., New York will continue as directors for another year. It was decided to hold the midwinter meeting of the association in Cleveland next January.

Labor Legislation

Chamber of Commerce of the United States, Washington 6, has issued a comprehensive analysis of new trends in state labor laws enacted during 1947, as compared with previous years. The 46-page folder, entitled "Trends in State Labor Laws," has been prepared by Anthony P. Alfino of the Labor Relations Section. Topics discussed include: Unfair Labor Practices, Compulsory Unionism, Check-off Clauses in Collective Bargaining Agreements, Secondary Boycotts, Labor Disputes in the Utilities Field, Discrimination in Employment, and Bargaining by Public Employees. A chapter on Area of State Jurisdiction describes new developments in the matter of concurrency of state jurisdiction with federal jurisdiction.

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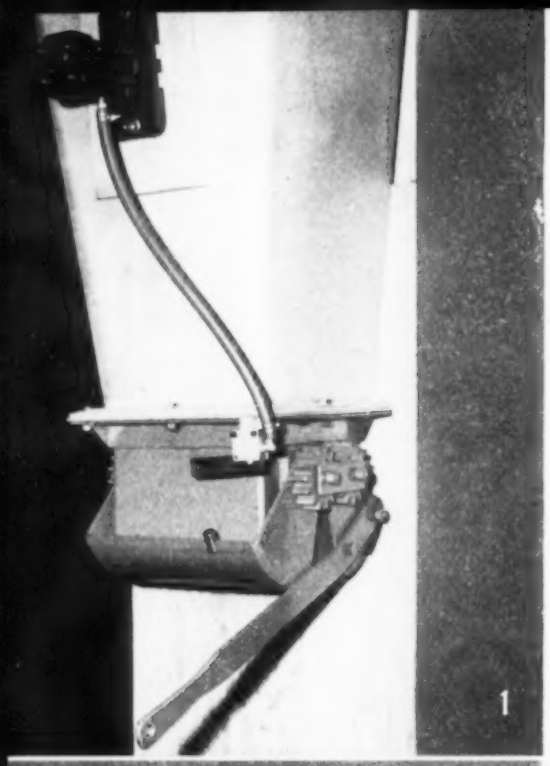
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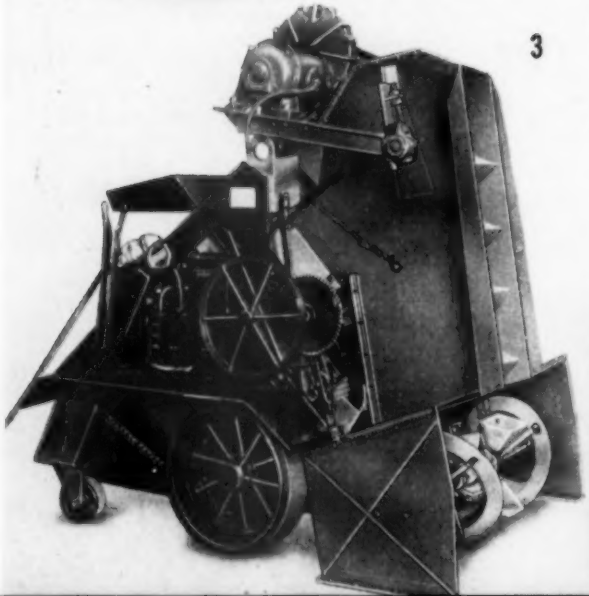
(1)—Vibrator: Cleveland Vibrator Co., 2828 Clinton Ave. West, Cleveland 13—Compressed-air-operated vibrator for molder's sand hopper is mounted on a reinforcing plate and the impact of vibration is directly against the skin of the hopper. Vibrator is manufactured in six sizes designed to speed the discharge of sand from all types and sizes of bins or hoppers. The average molder's hopper will require a 1⅝-in. or 2-in. piston diameter vibrator. The hopper operating valve shown here is actuated by movement of the gate. If the sand hangs in the hopper after the gate is opened, the molder opens the gate all the way, thereby actuating the valve supplying air to the vibrator and discharging the sand. Closing the gate automatically turns off the vibrator. This arrangement eliminates vibrator operation unless the sand hangs and avoids the possibility of vibration when the gate is closed.

2

(2)—Goggle: American Optical Co., Southbridge, Mass.—Lightweight safety goggle features an all-plastic frame with single plastic acetate lens providing maximum vision. Recommended for wear directly over the eyes or over spectacles for frontal protection against flying particles, these goggles have brown plastic frames and green or white colored replaceable lens. Metal temples are enclosed in acetate to prevent corrosion and are said to be easily adjustable. Each goggle is supplied with a leatherette case.

(3)—Sand Conditioner: Royer Foundry & Machine Co., 159 Pringle St., Kingston, Pa.—Self loading sand conditioner picks up sand from the floor with a large diameter screw, funnels it into conveyor buckets which empty their load onto a combing belt. A sand separator and blender then removes all trash, depositing it into a retainer bin. Lumps and balls are combed out of the sand, and it is blended and mixed with moisture, aerated and discharged at the rate of 40 to 50 tons per hour. Machine is 7 ft 3 in. high, 5 ft 4 in. wide, 7 ft 3 in. long and weighs approximately 5100 lb. Its three motors are controlled by switches located in a convenient panel. A "forward-reverse-stop" pushbutton station controls the variable-speed motor which drives the unit in either direction at 6.2 to 50.1 fpm. One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4

magnetic switch controls the gear head motor which powers the bucket elevator and screw and another controls the motor which operates the sand separator and blender. It is said that one man can operate the machine.

(4)—Blast Cleaning: Pangborn Corp., 1400 Pangborn Blvd., Hagerstown, Md.—Blast cleaning machine designed for above floor installation is equipped with a 6-ft diam rotary table and is capable of handling miscellaneous work such as gray iron and steel castings and steel structural parts of various shapes and sizes ranging from castings weighing a few pounds each to as much as 5000 lb, and up to 5 ft long and 30 in. high. Cleaning medium may be either shot or grit projected against the work on the table through a centrifugal wheel. The abrasive is recovered continuously, cleaned of sand, refuse and fines, and delivered to the centrifugal wheel for re-use—all operations carried out automatically until the load is considered clean. During blasting the blast compartment is completely closed, preventing escape of abrasive to the outside. For the suppression of dust, ventilating air is drawn through the inlet ducts at top of blast cabinet diagonally across the surface of the work being cleaned and out through the exhaust duct to the dust collector.

(5)—Snagging Grinder: Standard Electrical Tool Co., 2507 River Rd., Cincinnati 4—Redesigned twin-motor, infinitely variable speed snagging grinder is designed so that each wheel operates independently of the other. Grinding wheels may be of different diameters and each operated at its correct peripheral speed through a speed control which also permits speed adjustments for wheel wear. Wheel guards also are adjustable to wheel wear. Ball bearings are protected in oil reservoirs with labyrinth seals and sight feed oil gages. Four x 9-in. work rests are adjustable and removable.

(6)—Sand Preparation: Beardsley & Piper Division of Pettibone Mulliken Corp., 2424 North Cicero Ave., Chicago 39—Portable sand preparation unit for small foundries provides magnetic separation, screening and aeration of molding sand. In operation the machine is pulled or pushed to any floor in the foundry, plugged into an electrical outlet, the hopper loaded with up to ¾ cu yd of shakeout sand and then started. Bucket elevator elevates sand and discharges it over the magnetic separator which is said to remove even the shot iron. Sand drops into the Screenarator unit where it is screened, aerated and discharged at a rate of 20 tons per hour within a radius of 25 ft and 160 degrees. Machine is designed to discharge into a heap, windrow or container while the operator is getting another load of sand to supply the machine. Unit is built to swing to either side of the machine for discharging.

(7)—Sand Testing: Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4—Strength-deformation recorder is designed to be attached to the company's sand strength machine and may be used for either the green compressive strength test on the AFA 2 x 2-in. sand specimen or for the AFA core transverse strength test where a 1 x 1-in. baked core specimen is used. Recorder draws the stress-strain diagram on a printed chart which is ruled to show the compressive strength in pounds per square inch or load in pounds, for the core transverse strength. Deformation is measured on the horizontal axis with a ruler reading to 0.001-in. deformation in the case of the compression test and 0.001-in. deflection in the case of the baked core transverse test. Pounds per square inch are recorded on the vertical axis. Accurate to within 0.0005-in., the recorder is driven by a synchronous motor normally in an electrically braked position. A small amount of deformation or deflection of the test specimen releases the electrical brake, causing the recording pen to traverse either to the right or left. The pen is moved along the load axis by the position of the loading pendulum.

Power Accessories: O. F. DeCastro & Associates, Distributors, 674 West Washington Blvd., Los Angeles 15—Power accessories include die cast pillow blocks, collars and V-belt sheaves, circular blocks, and saw and grinding wheel mandrels. Pillow blocks have split cap bolted in position with 5/16-in. cap screws and spring-top oil cup. Split bear-

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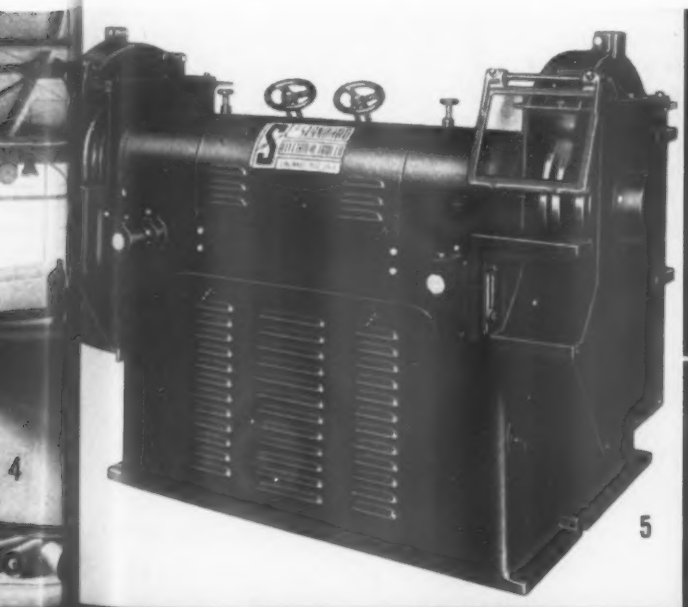
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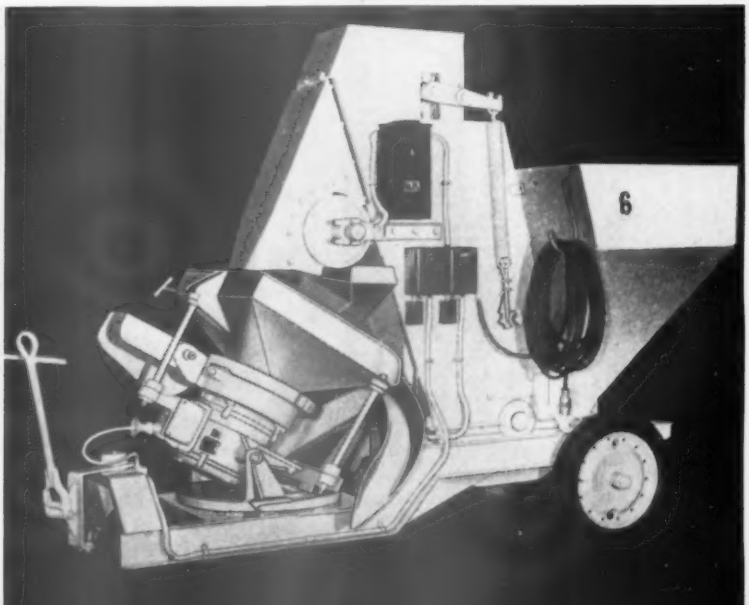
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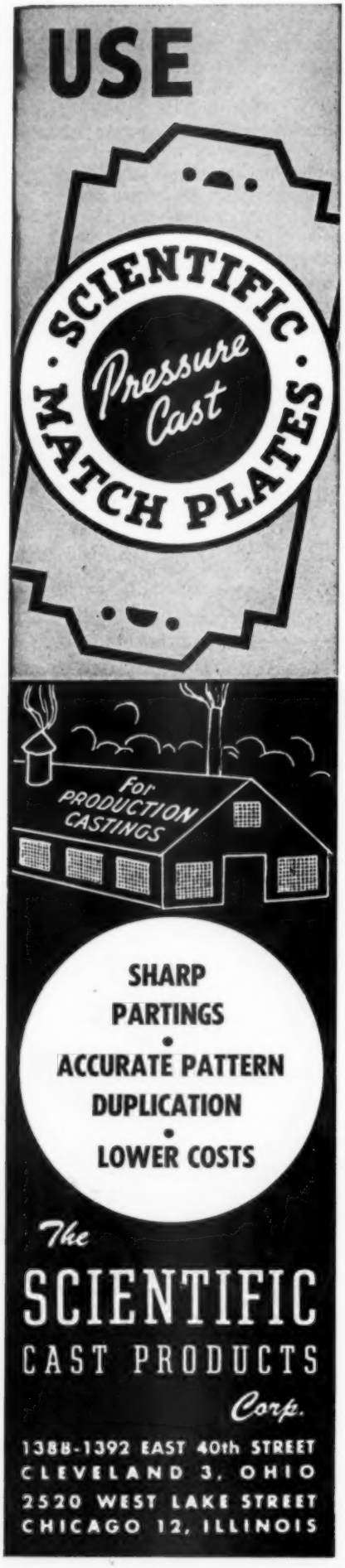


ings are furnished as replaceable inserts in both Zemac metal and bronze and are available in bore diameters of ½, ⅝, ¾ and 1 in. Steel mandrel assemblies are available in two types: Threaded at each end in right and left hand threads and threaded at one end only. Diameters are ½, ⅝, ¾ and ⅞ in.; overall lengths are 12, 14 and 16 in. Single 2-in. OD V-belt "A" section pulleys and 1¾-in. flanges are bored for mandrel sizes listed.

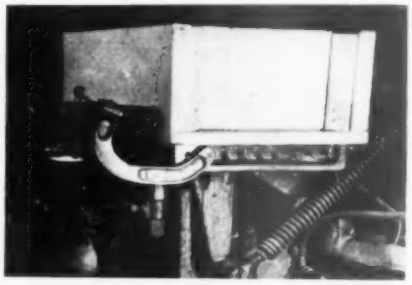
Air Hoist: Keller Tool Co., 1333 Fulton St., Grand Haven, Mich.—One-ton capacity air hoist is compact and ruggedly built. Variable speed control is said to permit operator to have full control of positioning, lowering or raising the load at any desired speed from creep to 17 fpm. Standard length of lift is 8 ft. Other features include safety stops, alloy steel roller chains and drop forged

swivel hooks. Power is furnished by a vertical piston type air motor. Weight of the hoist is 75 lb.

Electrode: All-State Welding Alloys Co. Inc., 96 West Post Rd., White Plains, N. Y.—Electrode is designed to produce machinable electric welds on cast iron at amperages in the 45-140 range. It has a nickel core and is said to offer good color match and freedom from spatter. It can be used on alternating or direct current and is obtainable in diameters of 3/32, 1/8 and 5/32 in.

Recording System: Applied Research Laboratories, 4336 San Fernando Rd., Glendale, Calif.—Recording system is said to greatly extend the range of application of the company's direct-reading instrument for spectrochemical analysis. The system, which employs removable plastic panels fitted with direct-reading scales for each element being determined, allows panels to be made up for each type of alloy. With this arrangement the instrument can be set up for the analysis of any alloy of a certain base metal in a few minutes, thus a producer of aluminum alloys, for instance, can analyze samples in the order received, quickly, irrespective of content.

Molding Machine Clamp: Triple A Machine Clamp Mfg. Co., P. O. Box 196, Leicester, Mass.—



Adjustable, combination ratchet-screw clamp is designed to hold core boxes and pattern boards to the table of hand roll-over molding machines. It mounts on any hinge or pedestal type hand roll-over machine and holds 95 per cent of all equipment without rigging or alterations, it is claimed. All major parts are made of cast aluminum alloy of 55,000 psi tensile strength, and the entire unit is assembled on an aluminum plate ⅛-in. thick. Holes for securing to the table are spotted in the proper positions with a template at the factory.

Blasting Nozzles: Mills Alloys Inc., 11320 South Alameda St., Los Angeles 2—Kirksite or steel jacketed blasting nozzles have tungsten carbide liners designed to withstand abrasive and shot used for cleaning purposes. Nozzles come in

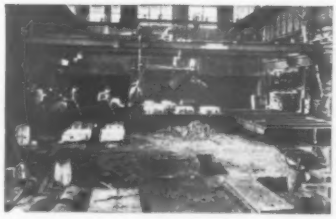
lengths of 1 to 6 in. with bores from 1/16 to ⅝ in. in increments of 1/16 in., and may be had with either threaded or socket ends designed to fit all makes of blasting machines with the aid of stock adaptors.

Pallet: Palmer-Shile Co., 16033 Fullerton Ave., Detroit 27 — Four-way, single face, all steel pallet is constructed of welded corrugated rolled steel. Special rolled channel steel face has center brace for extra weight loads. Designed for use with power lift and hand trucks, the pallet is built with beveled edges on two sides to permit trucks to ride over easily. Company builds pallets any gage, size or weight capacity to meet customers' specifications for specific manufacturing requirements or design.

Crane: Cardinal Corp., 1835 University Ave., St. Paul—Hydraulic lift crane of 2000-lb capacity has 45-in. boom to which may be attached an 18-in. extension arm for greater boom length if desired. Locator pin locks boom in proper working position. Handle operates double acting hydraulic pump and is said to require little effort to hoist loads. Crane is designed to hold loads at any height. The shop frame is made of formed steel and provides a stable platform for heavy loads. Three rubber-tired roller bearing wheels permit loads to be moved, and placing the towing handle in the upright position automatically sets the brakes, preventing crane from moving when hoisting or lowering loads.

Jointer Attachment: J. D. Wallace & Co., 157 South California Ave., Chicago 12—Attachment fits on company's 8-in. jointer making possible the planing of material 16-in. wide. It consists of a steel bar bolted in the rabbet ledge. Bar has an adjusting screw so that the end adjacent to the cutterhead can be adjusted tangent with the cutting circle of the knives. When not in use, the bar can be hinged back in the rabbet ledge, slightly below the surface of the rear table. When wide stock is planed, the bar is first folded back out of the way and the material

Conco FOUNDRY CRANES



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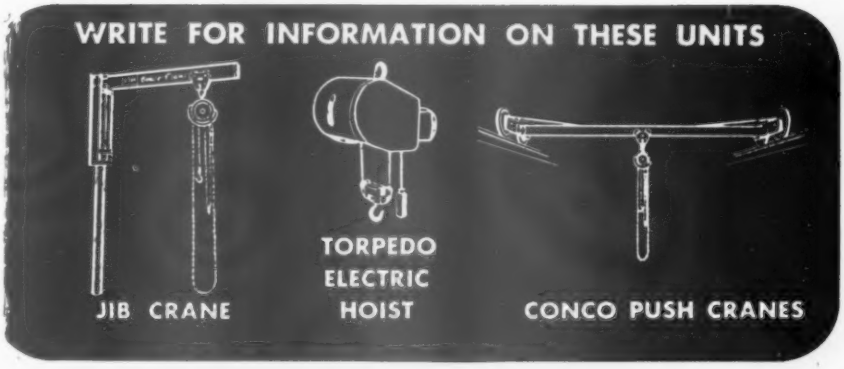

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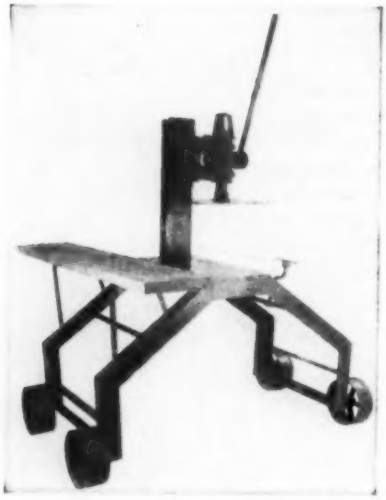

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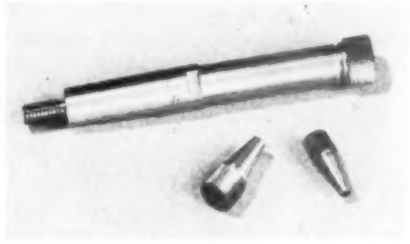
pushed through the machine to plane 8 in. of the surface. Then the bar is pivoted forward into position, and the stock is turned end for end so that the planed portion lies on the bar. Second cut is made without leaving a shoulder or joining mark, it is claimed. Same device may be used to plane draft on pattern work up to 8-in. wide.

Gear Assemblies: Lufkin Foundry & Machine Co., Douglas & Kiln Sts., Lufkin, Texas—Company's line of horizontal parallel-shaft herringbone gear speed reducers and increasers has been supplemented with a standard gear unit assembly of this type for all power transmission jobs. The assemblies are available in three standard types: Single reduction gear speed reducers are built in sizes ranging from 3 to 500 hp with any gear ratio up to 10:1; double reduction gear reducers are built with a range

of ratios from 10:1 to 75:1 in sizes from 1 to 300 hp; high-speed gear reducers and speed increasers are available in 33 sizes with any ratio up to 12:1. Loads up to several thousand horsepower can be transmitted and normal speed range is 3600 to 900 rpm. Pressure lubrication and cooling system are standard equipment.

Moisture Determinator: Laboratory Equipment Corp., 720 East Main St., Benton Harbor, Mich.—Moisture determinator is designed to measure the percentage of moisture in a variety of substances, employing a principle of generating acetylene gas by bringing the moisture of the sample tested into positive contact with an excess amount of calcium carbide. The quantity of gas thus generated correlates with the percentage of moisture present in the sample. Instrument can be calibrated over any desired range of percentage of moisture. Standard laboratory model is calibrated from 0 to 17.5 per cent with a reading accuracy of 0.1 per cent.

Mills: Severance Tool Industries Inc., 753 Iowa St., Saginaw, Mich.—Micro-mills for internal finishing are available in sizes 3/8 to 1-1/2 in. diameter having tapered



shanks. It is claimed that standard internal grinding spindles or quills can be adapted for the mounting of these mills and that instant and positive alignment is realized. This is made possible by mating two steep tapers and securing the mill in place with a retaining screw. Besides qualifying for the ordinary run of internal grinding work ranging up to Rockwell 62-C hardness, these mills are said to be adaptable for post-hardening alterations where large amounts of stock removal are involved.

Furnaces: Westinghouse Electric Corp., Box 868, Pittsburgh 30—Gas-fired furnaces for annealing, carburizing, drawing, hardening, spheroidizing, malleablizing, normalizing, and dry cyaniding are designed for use with separately prepared protective atmospheres. These furnaces supplement the company's regular line of electrically heated industrial furnaces.

Asbestos Gloves: Industrial Gloves Co., 700 Garfield, Danville, Ill.—Leather reinforced asbestos

gauntlet eliminates the usual seam on the palm, where thumb and palm are joined. This feature provides a continuous leather wearing surface

over the asbestos palm, fingers and thumb. The seam that makes the thumb is on the top edge of that digit, well out of the wearing zone. Gloves may be had lined or unlined —11 or 14-in. are standard lengths. Special lengths made to order of the customer.

Thermometer Fittings: Manning, Maxwell & Moore Inc., 11 Elias St., Bridgeport 2, Conn.—New method of adapting compression type fittings to thermometer bulbs is said to permit changing thermometers originally made with plain bulbs to union connection. Compression fittings are applied directly to the bulb to produce any desired length up to 6 in. A separable socket may be provided by welding or soldering a well to the union bushing.

Fork Truck Shovel: Clark Tructractor Division, Clark Equipment Co., 258 Champion St., Battle

Creek, Mich.—Fork truck shovel attachment has a pneumatic snubber which minimizes shock and strain to the upright assembly when the load is discharged. Built of ¼-in. steel plate with a 6-in. wide hardened steel blade welded to the bucket, the shovel has 3-point suspension with a roller cam lock and a single point hook which releases any load with a 15-lb pull. Shovel is interchangeable with forks and all other attachments mounted directly to the standard fork bars on the company's fork trucks.

Metallizing: Metallizing Engineering Co. Inc., 38-14 30th St., Long Island City 1, N. Y.—Newly developed metallizing gun is designed to use only 10 cu ft of air per minute. It features new turbine and nozzle construction and a single adjustment for the entire range of metallizing wires. Gun weighs only 4 lb, 2 oz and will spray all kinds of metals by hand or machine on all kinds of work, it is claimed. Company also has devel-

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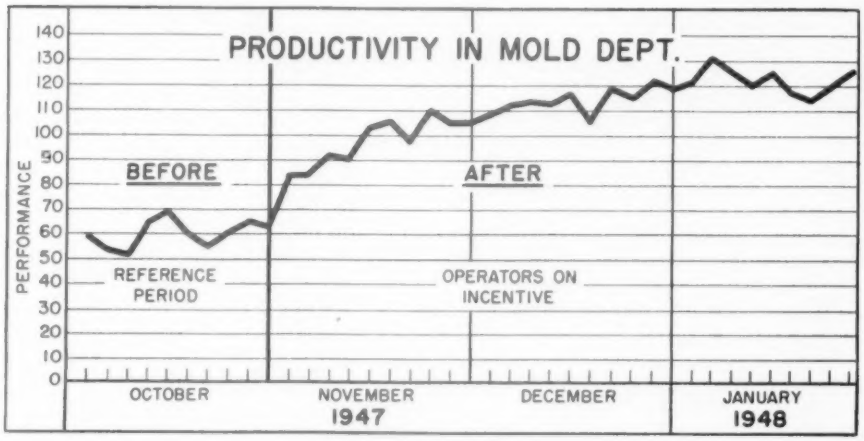

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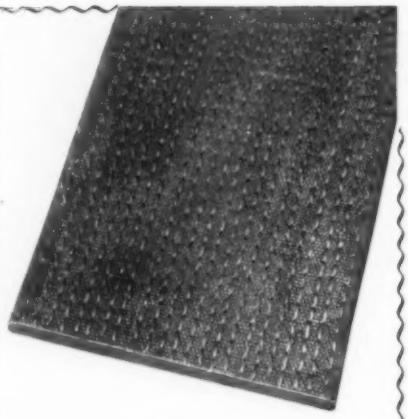

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oped a new metal for use in its metallizing guns which may be sprayed directly onto smooth, even highly polished steel, and many other materials without any surface preparation other than cleaning.

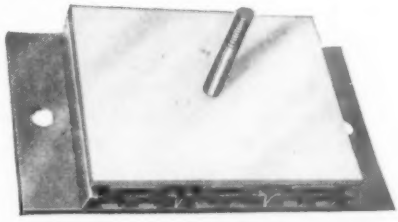
Liquid Level Alarm: Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland—Device sets off warning signals when liquid levels in small boilers or various types of tanks reach predetermined low or high levels and can be used on pressures up to 250 lb. An electric switch is operated through a permanent magnet when a float rises or falls in a separate float chamber. Switch can be wired for a normally open or normally closed circuit and is said to be dust, vapor and explosion-proof.

Goggle: Chicago Eye Shield Co., 2300 Warren Blvd., Chicago 12—Newly designed goggle incorporates

a new type forehead rest and balanced temple suspension. One-piece, replaceable plastic lens provides large coverage vertically and laterally to protect the entire eye area from sparks, light impacts, liquid splashes and other hazards. Visibility is said to be undistorted. Goggle weighs 1 oz and is designed for quick adjustability to fit various faces.

Rustproof Coating: Kano Laboratories: 75 East Wacker Dr., Chicago 1—Rust preventive is applied cold by dipping, spraying or brushing and dries in about 15 minutes to a clear, hard, dry surface. It is said to be tough, flexible and nonporous and to have the capacity of creeping under and displacing moisture and finger prints. It is intended to offer protection under ordinary indoor conditions for periods up to 6 months. For more severe conditions it can be removed with any petroleum solvent and replaced at regular intervals. It is not necessary to remove it prior to painting.

Vibration Dampeners: Finn & Co., 2850 Eighth Ave., New York 30—Self-contained vibration dampeners are drilled and tapped and are said to be ready and easy to install. The design invoves no rubber-to-metal bonds. Synthetic rubber inserts are held in place by steel retaining brackets and are claimed to be impervious to oil, water, sunlight,



grease and cleaning solvents. Two types of mounts are available: One for horizontal and rotary vibration and one for vertical vibration in top heavy and recoil type machines.

Sheaves: Worthington Pump & Machinery Corp., 401 Worthington Ave., Harrison, N. J.—Adjustable pitch diameter sheaves are available in 14 sizes—7 single groove and 7 double groove. Arrangement of the single groove sheave incorporates a stationary flange with a hub which is bored, keyseated and provided with a set screw that enables shaft adaptability. Outside diameter of the hub is threaded to suit the removable flange. It is also milled at 180 degrees to receive positioning set screws in the loose flange. The double groove sheave is identical except that here the stationary flange is the center spider for the two grooves and is provided with threaded hubs to receive loose flanges on both sides.

Timing Device: Precision Scientific Co., 1736 Springfield Ave., Chicago 47—Timing device for auto-

matically controlling the percentage of time which an alternating current circuit will be on or off out of a definite period of time is designed for regulating the input to electrically operated furnaces, ovens, heaters and baths, or, for example, to control the proportionate flow of chemicals such as treatment of boiler feed water.

Range of the device is approximately 5 to 60 seconds, and the percentage of 60 seconds that the timer is "on" is controlled by turning the reference dial.

Pyrometer: Cole Instrument Co., 1320 South Grand Ave., Los Angeles 15, Dept. C—Small, compact wall mounting type pyrometer has high torque pyrometer movement and is designed to withstand vibration and other hazards of industrial use. It is mounted in a cast aluminum case said to be splash and dust-proof and equipped with mounting lugs. Insulated binding posts are provided at the bottom of the instrument for attachment of thermocouple leads. Any type of thermocouple suitable for the various temperature ranges may be used with the instrument. The model illustrated is furnished with automatic cold end compensation in the lower ranges. In

the higher ranges manual compensation is normally provided, although automatic compensation can be furnished at extra cost.

Electrodes: Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30—Two new electrodes for ac and dc welding of cast iron are known as Castingweld and Freemachineweld and were developed to hold thermal stresses to a minimum and to prevent extreme hardness in the heat affected zone. Castingweld uses a mild steel core wire and a low melting point coating that is designed to overcome difficulties with entrapped slag. The deposit is relatively hard and not machinable. It is available in 3/32, 1/8 and 5/32-in. diam. Freemachineweld uses a pure nickel core wire intended to help control welding stresses, as the melting temperature of nickel is low and its expansion and contraction more closely matches that of cast iron. Weld is soft and machinable. It is available in 1/8 and 5/32-in. diam.

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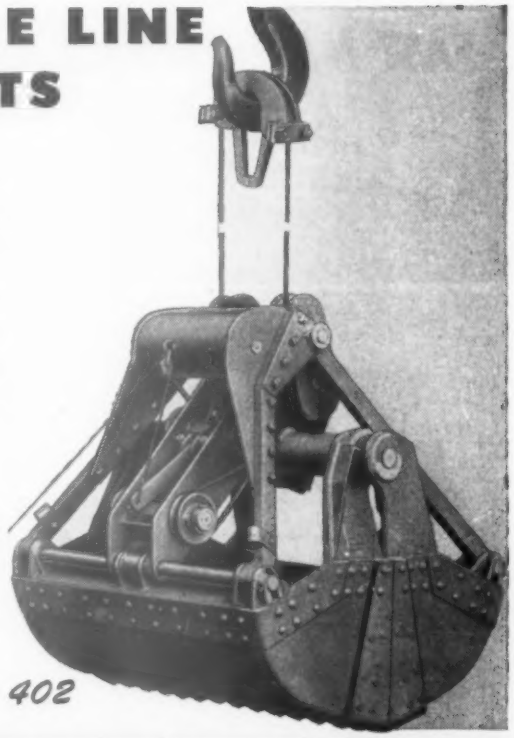

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STORAGE BATTERIES: Gould Storage Battery Corp., 467 Calhoun St., Trenton 7, N. J.—Brochure features the company's research laboratory and discusses raw materials specification and testing, voltage measurement, complex metallic compound analysis, the study of crystalline structure of cast lead and the proving of products of research. Additional folder describes a line of industrial batteries giving specifications.

PROCESS-IRON CASTINGS: McNally Pittsburgh Foundries Inc., 315 West Third St., P. O. Box 329, Pittsburg, Kans.—Bulletin 1115 contains information for the buyer and user of iron castings about the company's modern process-iron founding technique for producing castings to exact specifications. Booklet includes analytical data on process cast iron and a specification summary on iron castings.

BACKSTOP: Falk Corp., 3001 West Canal St., Milwaukee 8—Bulletin 10,080 provides complete information on the construction and operating advantages of the company's backstop which is said to provide a positive method for preventing reverse rotation on conveyor drives, elevator head shafts, windlasses, winches, and on all applications where reverse rotation should not occur.

STARTER: Electric Machinery Mfg. Co., 1331 Tyler St. N. E., Minneapolis 13—Booklet 192 shows construction, operation and application of combination starter for high voltage induction and synchronous motors for industry. It also describes how high interrupting capacity fuses provide short circuit protection.

CORE OIL: Werner G. Smith Co., 2191 West 110 St., Cleveland 2—Pamphlet presents in graph form results of the company's recent studies on how baking temperature, moisture content, silica flour, iron oxide, and cereal binders affect the baked tensile strength of cores.

ALLOYS: Cerro de Pasco Copper Corp., Dept B-7, 40 Wall St., New York 5—The first few loose-leaf form sheets of a series to be published contain information and illustrations on the applications and uses of the company's low-temperature melting alloys.

THERMOCOUPLE WIRE: General Electric Co., Apparatus Dept., Schenectady 5, N. Y.—Bulletin GEA-4881 lists various types of thermocouple wires and insulation materials for measuring temperatures in industrial processes and laboratories. Data on application, selection, accuracy of thermocouple materials, and pricing information are included. Bulletin GET-1415 gives output characteristics of the common thermocouple-wire materials. Tables list temperature vs emf and emf vs temperature in both Fahrenheit and Centigrade scales.

WELDING PRODUCTS: American Manganese Steel Division, American Brake Shoe Co., 389 East Fourteenth St., Chicago Heights, Ill.—Bulletin 1047-W describes hard-facing and build-up rods and electrodes, and weldments designed to conserve and protect wearing parts. Numerous illustrations of applications are included.

VALVES: R-S Products Corp., Wayne Junction, Philadelphia 44—Designed to give maximum information of practical use to engineers specifying valves for industrial work, catalog 17 contains more than 70 half-tone illustrations and tables keyed to drawings showing dimensions of the company's butterfly or disc type valves.

DIE LUBRICANT: G. W. Smith & Sons, 5400 Kemp Rd., Dayton, 3, O.—Folder outlines the general properties and advantages of the four grades of compound available for die-casting die and machine lubrication. It recommends specific grades to be used in producing zinc, aluminum, magnesium, brass or lead die castings.

PAINT: Speco Inc., 3142 Superior Ave., Cleveland—Booklet describes a new wood preservative paint developed to prevent rot and decay and to be especially adapted for wood that is to be buried in the ground or laid on an earth surface. Because of its creosote content, it is poisonous to bacteria and repels insects.

ASBESTOS: Johns-Manville Corp., Box 290, New York 16—Brochure SP-70 shows asbestos mining operations, carding and spinning machines and the various asbestos textile products made by the company, including reproductions of ten popular styles of asbestos cloth. Uses for asbestos textiles are discussed.

PROFIT SHARING: Charles D. Spencer & Associates Inc., 166 West Jackson Blvd., Chicago 4—Booklet explains the U. S. Treasury Approved profit sharing plans under which both the employers and employees are accorded favorable income tax treatment.

LAMPS: Westinghouse Electric Corp., Lamp Division, McArthur Ave., Bloomfield, N. J.—Sixteen types of mercury lamps are described in

CLEVELAND VIBRATORS
for 'trouble-free' use on MATCH PLATES, MOLDING MACHINES, HOPPERS, CHUTES, SCREENS and SHAKEOUTS.
THE CLEVELAND VIBRATOR COMPANY ★ 2828 CLINTON AVE. ★ CLEVELAND 13, OHIO

booklet A-5112. Booklet contains information on electric discharge through vaporized mercury; technical data for the types available; spectral radiation characteristics of vapor lamps at different arc pressures; auxiliary equipment available; operating characteristics of vapor lamps; lamp construction; lamp life and lumen maintenance; effect of ambient and lamp temperatures on lamp life; and application information.

DEW POINT RECORDER: Surface Combustion Corp., 2375 Dorr St., P.O. Box 907, Toledo 1, O.—Bulletin SC-137 describes industrial uses of the recorder and how it is used in connection with the transmission of natural gas. It explains how the instrument automatically records dew point of the atmosphere supplied to it and how the atmosphere selector, which permits multiple atmosphere checking, operates.

BUFFING CLOTHS: Divine Bros. Co., 200 Seward Ave., Utica 1, N. Y.—Bulletin FDB-3 shows ten samples of cloth used for making buffs. The actual material is glued on the pages in such a manner that it can be examined readily. Beside each swatch is a brief description of the recommended use for that quality.

ELECTRODES: Welding Equipment & Supply Co., 223 Leib St., Detroit 7—Wall chart designates each type of the company's electrodes with its characteristics, recommended uses, sizes available, properties of welds produced and color code. Included are illustrations of typical applications.

MOISTURE MEASURING: American Instrument Co. Inc., 8024 Georgia Ave., Silver Spring, Md.—Bulletin 2164-308 describes a line of electric hygrometer equipment suitable for exacting industrial and laboratory applications. Included are selection charts, diagrams and calibration curves.

ROOFS: Philip Carey Mfg. Co., Dept. 803, Lakeland Ave., Cincinnati, 15—Catalog of specifications for built-up roofing contains drawings and material specifications for hot and cold process built-up roofs. Index shows how to select the correct type of bonded built-up roofing.

MEEHANITE: Meehanite Metal Corp., Pershing Square Bldg., New Rochelle, N. Y.—Bulletin 28 answers seven fundamental questions to explain what Meehanite metal is and the basic characteristics which it makes available to industrial users of iron castings.

BORON ALLOY: Norton Co., 1 New Bond St., Worcester 6, Mass.—Leaflet presents facts in a question and answer style about a chemically balanced alloy of boron and iron for adding boron to steel and cast iron.

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NOZZLES
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ECONOMICALLY BY
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THEY DO SAVE TIME
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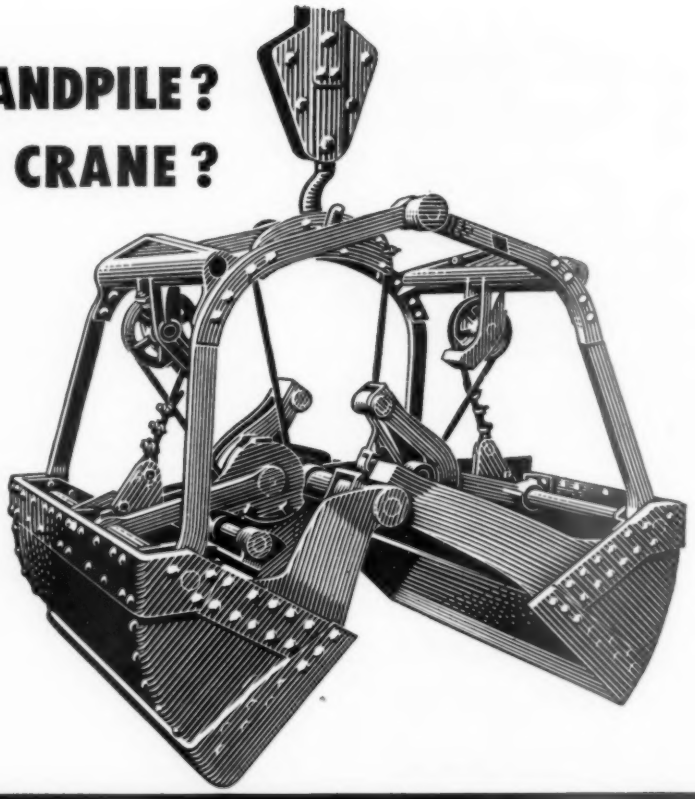
BLASTING EQUIPMENT

HOW HIGH IS YOUR SANDPILE?
HOW LOW IS YOUR CRANE?



Here's a Blaw-Knox Single Line, Hook-On Type Bucket that needs only 6' 7" operating headroom! Perhaps one of the 4 sizes of this design will prove exactly what you need for efficient handling of moulders' sand, coke, slack coal or other loose bulk materials. You'll find it fully described in Catalog 2232, which will be forwarded immediately on request.

BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
2097 FARMERS BANK BUILDING
PITTSBURGH 22, PA.

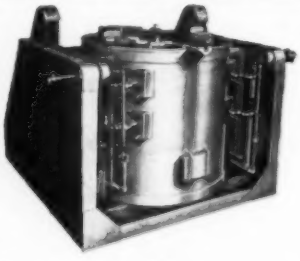
BLAW-KNOX *FOUNDRY* BUCKETS

NON-FERROUS METAL MELTING FURNACES

SELECTION TABLE

	TYPE	Max. Temp.	Series	Recommended for	Bulletin No.
TILTING	CRUCIBLE	2500°F.	TCR	Melting Brass and Copper	TC-45
		1400°F.	TCA	Melting Aluminum	TC-45
	POT	1400°F.	TP	Melting Aluminum and Magnesium	TP-45
STATIONARY	CRUCIBLE	2500°F.	CR	Melting Brass and Copper	CR-45
		1400°F.	AC	Melting Aluminum	AC-45
	POT	1400°F.	AM	Melting Aluminum	AM-45
		1200°F.	SM	Melting Soft Metals	AM-45
		1000°F.	SA SAV	Melting Soft Metals	SV-45

26348



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FASTER AND BETTER
with the
MURPHY PISTOL SPRAYER
ELIMINATES SWAB, BRUSH and SPRAY CAN

BLACKENING REACHES HIDDEN POCKETS
MOLDS ARE BLACKENED FASTER
CASTINGS PEEL BETTER
WORK COMES CLEANER
Satisfactory Performance Guaranteed or Money Back

PRICES COMPLETE WITH SUCTION HOSE AND SINKER

PIPE SIZE	1/16"	1/8"	1/4"	3/8"	1/2"
PRICE F. O. B. HAMILTON, O.	$12.00	$12.00	$12.00	$14.50	$18.00

Used for Silica wash, oil, water or any liquid material. For sand-blast cleaning. As a blow gun for cleaning motors and machinery. If your dealer cannot supply you at once, order direct from manufacturer below. Literature on request.

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ALL CAPACITIES
ALL TYPES
Including
Timken worm geared Ladles with *Industrial's* patented distortion-proof, self-locking design

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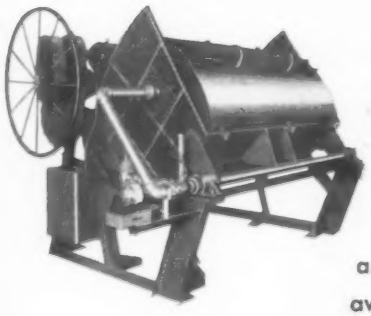
PRESSED STEEL
WELDED STEEL
RIVETED STEEL
Including
flat bottom, round bottom, and teapot spout types



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Jomac Heat and Flame Resisting Gloves find ready approval with cost experts . . . for they *give up to 700 percent the wear of* ordinary work gloves. They can be washed or dry-cleaned repeatedly without losing any of their original flexibility, wearability, or heat resistance.

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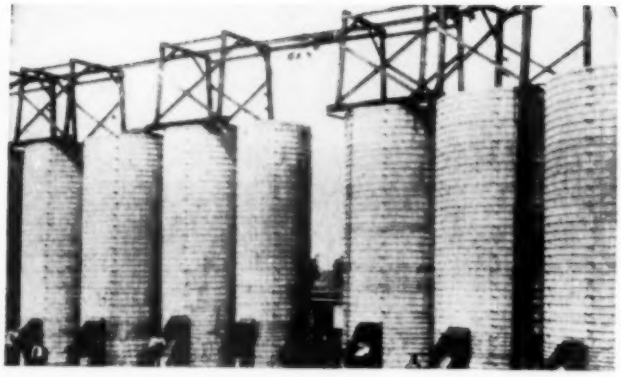

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Massey, Wood & West of Richmond, Va., store coal in ten Neff & Fry bins. Coal is hoisted into the bins with conveyors from dump pits, then loaded into delivery trucks by gravity.

Says the foreman, comparing this operation with one not so equipped, "We deliver more coal with half as many trucks."

Similar savings are experienced wherever Neff & Fry storage systems are employed in handling all sorts of flowable bulk materials. And because Neff & Fry super-concrete storage bins last a generation with virtually no maintenance, they pay for themselves again and again through savings.

You should get complete information from us if you're interested in the most satisfactory and most economical storage.

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"OLIVER"
No. 159 Motor Driven
SPEED LATHE

A precision-built easy operating wood turning Lathe for pattern shops

On work within its capacity this "Oliver" Speed Lathe can save your pattern makers valuable time. It swings 12" diameter, 24" between centers, bed 48" long. Unit type motor and V-belt driven headstock give spindle speed from 800 to 2750 r. p. m. Switch has overload protection. Spindle lock simplifies removal of face plates. Write for Bulletin No. 159.

"Oliver" makes a complete line of woodworking machines for pattern shops

OLIVER MACHINERY COMPANY
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Prove to your own satisfaction *by actual trial*, what hundreds of foundries have discovered . . that you get better cores at lower cost by using DAYTON CORE OIL. As a result, you get cleaner, more uniform castings. Our representatives are trained by years of experience to help you solve your core production problems. Order a drum of Dayton Core Oil . . test it! We believe you'll want to use it exclusively thereafter.

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STOP RUINED MOLDS!

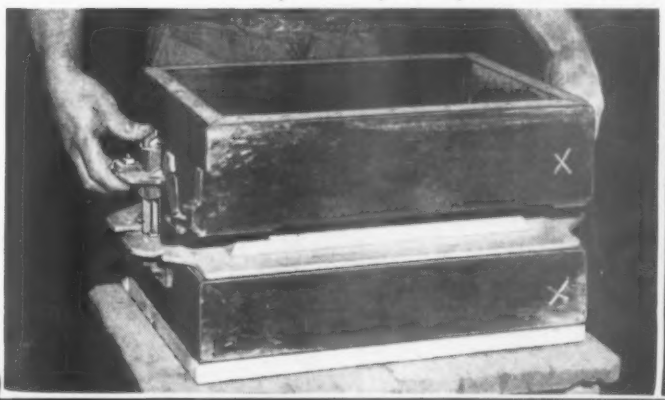
GET PERFECT LIFTS EVERY TIME WITH BUCKEYE "3-IN-1" FLASK GUIDES!

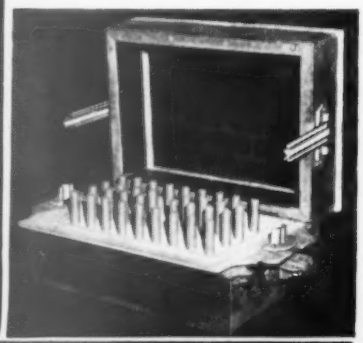
(Patented)

No longer need foundrymen worry over the problem of ruined molds due to the cope shifting while being lifted from the drag. This costly annoyance was solved with the introduction of Buckeye "Three-In-One" Patented Flask Guides.

Because of the patented three V-shaped tongues on the pin, the cope doesn't rock or shift when lifted — you get a true perpendicular lift every time. Pin, slide and match plate lugs are interchangeable; no need to realign if replacement is required. Furnished in 3, 4, 5, 6, 7 and 8" lengths for all straight or tapered flasks.

If you want perfect pattern contour, reduced costs and increased production, write to Buckeye for full details and prices today.





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This machine is furnished in two sizes: 10" squeeze cylinder with 3" jolt cylinder and 12" squeeze cylinder with 4" jolt cylinder.

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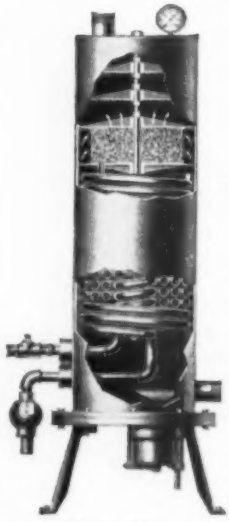

Capacities
50 to 2000 CFFAPM
Sizes
1" to 4"

COOL ● CLEAN ● DRY
TO POINT OF USE

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INSTALL A
MURPHY A.S.F.

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Guaranteed not alone to cool, clean and dry compressed air, but to deliver it so to point of use.

Built in 1", 1½", 2", 3", and 4" sizes, with capacities of 50 to 2,000 CFFAPM.

Completely automatic and highly efficient. Guaranteed to perform as advertised or money back. Write for literature and prices.

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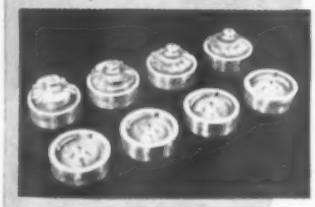

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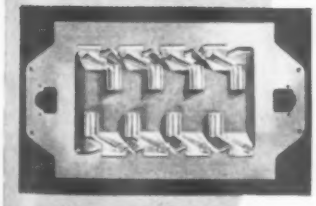
Completely machined brass cope and drag pattern inserts for motor end frames. Hi-accuracy permits interchangeability.



Aluminum Match Plates

Single or multiple sections from one master pattern. Precision cast. Low clean-up time.

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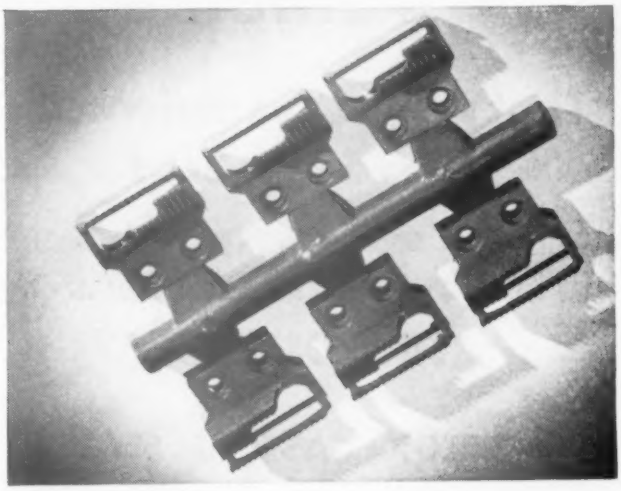

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Here's a good example of the high precision that can be obtained by using ZYROX Pattern Waxes for "Lost Wax" casting patterns. These small sewing machine parts have close tolerances, a satin-textured surface, and need no finishing other than cutting away the sprue.

Six years of foundry experience have established ZYROX Pattern Waxes as the dependable low-cost industrial wax for "Lost Wax" castings. ZYROX Pattern Waxes provide dimensional stability, no distortion, and accurate reproduction of die surfaces to produce precision parts at less over-all cost.

Now "Lost Wax" casting with ZYROX Pattern Waxes offers you new freedom in the design of intricate precision parts. Alloys impossible to forge or machine can be cast to tolerances of ±.003 inch per inch in parts weighing up to 20 pounds and measuring 15 inches in length.

For information on ZYROX Pattern Waxes in "Lost Wax" casting, write to Department H-1.

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An exterior coating for furnaces and ovens that is remarkably durable and is expressly formulated to stand up under extreme heat. Iron plates, painted with Waterlox Hades Aluminum, can be heated to a bright red color (1350 degrees) and when the metal cools the original bright, silvery color remains unchanged. It will not flake, chip or peel.

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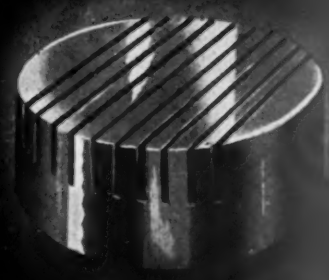
Precision



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Here's part of a complete line of DEMMLER core box vents—rigidly constructed in varying sizes of slotted brass—slotted steel—and screen mesh. Orders filled promptly from stock!

BRASS SLOTTED CORE BOX VENTS
Slot widths: .010", .013", .015"
Diameters: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8", 1", 1 1/4", 1 1/2"

STEEL SLOTTED CORE BOX VENTS
Slot widths: .010", .013", .015"
Diameters: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8", 1", 1 1/4", 1 1/2"

SCREEN TYPE CORE BOX VENTS
Mesh: #30, #40, #50.
Diameters: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8", 1", 1 1/4", 1 1/2"

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Wm. **DEMMLER** *& Bros.*
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HIGH SPEED
STAND GRINDERS

- SIMPLICITY OF DESIGN
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Featuring double ball-bearing construction and efficient single-wheel mounting.

Grinding wheel rotates on double bearings around a dead shaft anchored at both ends—completely eliminating all vibration and shaft whip . . . and the entire unit guaranteed for two years!

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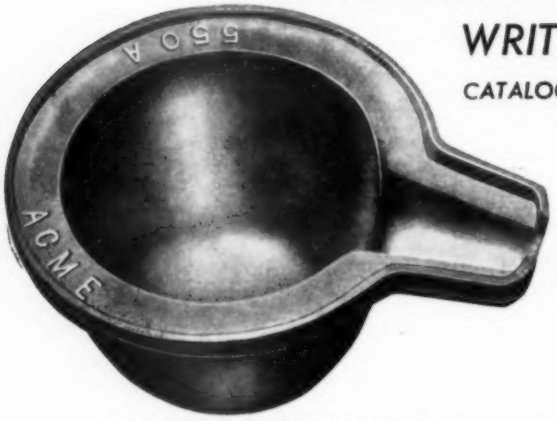
for ALUMINUM AND OTHER NONFERROUS METALS. 45 SIZES.



ROUND SPOUT POT NO. 550A
WITH 1½" COLLAR ON FLANGE

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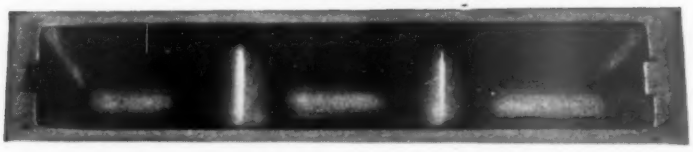
CATALOG "F"

HOLDING——→
BOWL NO. HP7001



INGOT MOLD NO. AA-6

Made of Acme SPECIAL-M-Heat Resisting Iron — They Stand the Heat!

ACME FOUNDRY COMPANY

DETROIT 16, MICHIGAN

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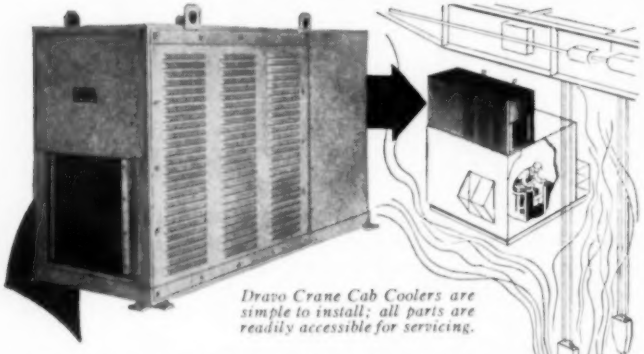

Dravo Crane Cab Coolers are simple to install; all parts are readily accessible for servicing.

DRAVO CRANE CAB COOLERS
ASSURE OPERATOR COMFORT

Operators of hot-metal cranes are more alert and efficient when you protect them from fatigue and discomfort by air conditioning the cabs with Dravo Crane Cab Coolers.

Completely self-contained, and requiring only an electrical connection, the Dravo Crane Cab Cooler provides complete air conditioning:

Cooling	Continuous Ventilation
Fume and Odor Removal	Dehumidifying
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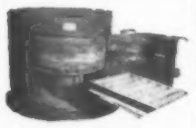
CENTRIFUGAL CASTING MACHINES

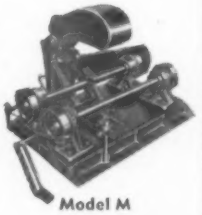


Model AS

These machines used to make ferrous and non-ferrous centrifugal castings are produced by the pioneer manufacturer of such equipment.

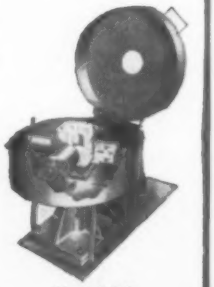
Model J

They are made in a large variety of styles and a wide range of sizes. Complete technical information is supplied concerning sand and permanent mold design, gating, sand mixes, speeds, etc.



Model M

Send us drawings or sketches of parts you are interested in casting centrifugally, and we will tell you, without obligation, if and how our machines can cast them faster, cleaner and with fewer rejects.



Model J-P

CENTRIFUGAL CASTING MACHINE COMPANY

Nathan Janco, *President*

P. O. Box 947 **Tulsa 1, Okla.**

No need for battleship *thickness* in flask walls. Correctly engineered thickness, highly durable materials, and scientific design, as exemplified in Truscon Steel Flasks, give battleship *service* without unnecessary weight or shop handling costs. ● Truscon Steel Flasks have a long record of success in foundry operations, particularly under extreme conditions of heavy service. An experienced Truscon man will be glad to explain the many advantages which Truscon Steel Flasks offer you.

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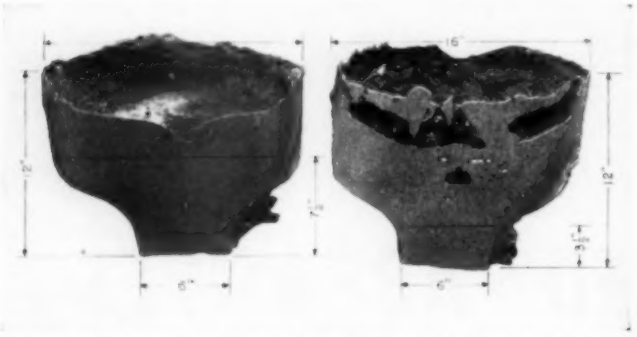
SOFFEL'S CARBON FREE *Liquidizer*

KEEPS METAL MOLTEN 50% LONGER

FOR FERROUS AND NON-FERROUS METALS



RISER ON LEFT, THROUGH THE ACTION OF SOFFEL'S CARBON FREE LIQUIDIZER, CONTAINS TWICE AS MUCH SOUND METAL AS THE HEAD ON THE RIGHT, ON WHICH A COMMON INSULATING PIPE ELIMINATOR WAS USED.

These risers, made in the same mold, illustrate how SOFFEL'S CARBON FREE LIQUIDIZER produces sounder castings and saves metal.

STEEL INGOT YIELD INCREASED BY 4% AND MORE

One of the many steel ingot producers using SOFFEL'S CARBON FREE LIQUIDIZER has found that the application of the material on "hot-top" ingots increased their yield 4% and resulted in a saving of $4.00 per ton of steel in the production of ingots. For every ten cents invested in SOFFEL'S CARBON FREE LIQUIDIZER, one dollar was returned in savings.

These amazing results were due to the action of SOFFEL'S CARBON FREE LIQUIDIZER. When applied on molten steel, the LIQUIDIZER enters into an exothermic reaction which produces a temperature of over 3200°F. The heat generated raises the temperature of the feeding metal in the hot-top and causes it to remain fluid 50% longer. After the exothermic reaction has ceased, the LIQUIDIZER forms a soft, insulating cover on the metal, thus confining the heat and further delaying solidification. By prolonging the fluidity of the metal in the hot-tops, the "piping" is eliminated from the ingot body. This greatly reduces "croppage" scrap.

NOTICE: SOFFEL'S CARBON FREE LIQUIDIZER is guaranteed not to contaminate any metals or alloys in any way.

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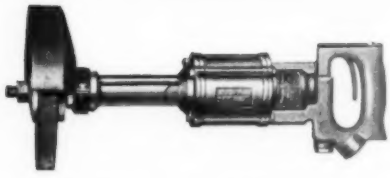

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LASTS MANY TIMES LONGER

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AMASTEEL is produced under exclusive patents and is available in sizes that meet all CLEANING and PEENING requirements.

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For years, industrial physicians and safety engineers have recommended salt tablets as low-cost insurance against the loss of efficiency and man-hours that "heat fatigue" causes. But it is vitally important that workers **accept** the salt tablets you provide them—are sure they are pure, reliable, safe.

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Undoubtedly most of your employees use Morton's Table Salt in their homes. They know it is dependable and pure. So they accept Morton's Salt Tablets. They know they are a wholesome health aid backed by a familiar name.

Cost less than 1¢ a man per week

Morton's Heat Relief Salt Tablets—the best that money can buy—cost so little. Can you afford to be without "heat fatigue" protection in your plant? Order Morton's Salt Tablets and Dispensers from your distributor, or directly from this advertisement. Write for free folder. MORTON SALT COMPANY, 120 So. La Salle St., Chicago 3, Ill.

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★ Increase Tensile Strength
★ Increase Transverse Strength
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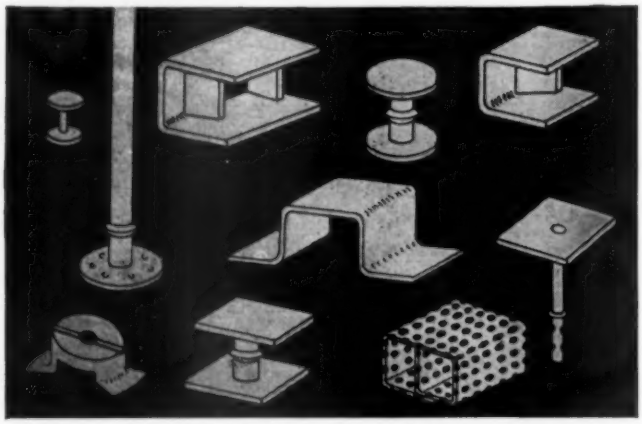

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Penton's Foundry List is recognized as the only list of foundries giving such valuable information arranged for quick, ready reference.

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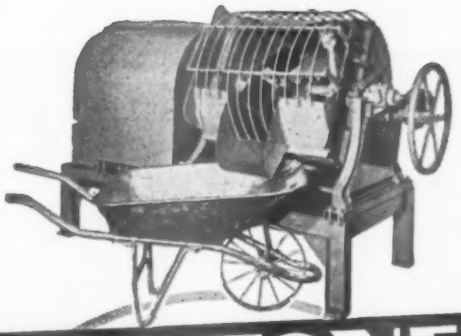

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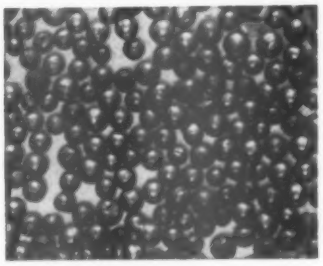

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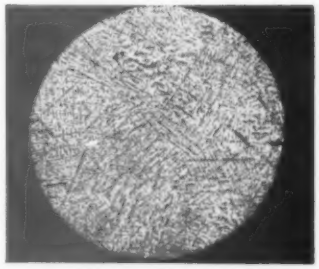

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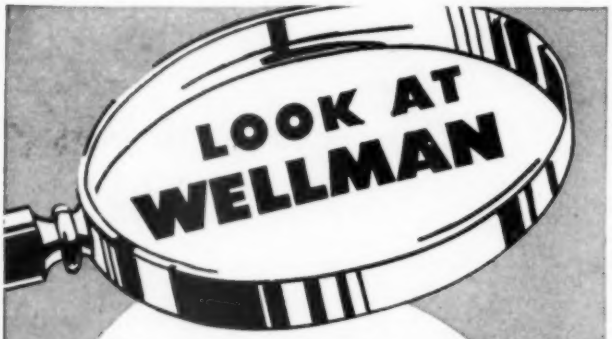

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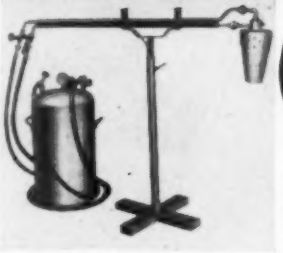

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HELPFUL LITERATURE

NOTE TO READERS: If you will check the item or items described which particularly interest you, we will be glad to request the manufacturers concerned to send you their literature. Use the attached postal card.

1. Grinding Wheels

Electro Refractories & Alloys Corp.—64-page illustrated catalog 645 outlines advantages possible with Electro grinding wheels in high speed grinding operations. Construction elements and functions, hardness, resin bonding and other features are discussed. Numerous different types of wheels are covered.

2. Alloy Steels & Irons

Vanadium Corp. of America—36-page illustrated booklet "Vancoram Alloys—Metals-Chemicals" describes Vancoram brand products which are available in a variety of forms to meet individual demands of metallurgical requirements. Some 36 different products are covered in publication.

3. Foundry Conveyors

Palmer-Bee Co.—32-page illustrated booklet "That New Look" contains data and installation information about complete line of foundry conveyors. Lubricated for life antifriction bearings are standard equipment.

4. Refractory Material

Cleveland Quarries Co.—22-page illustrated bulletin No. 15-B describes Buckeye silica firestone natural refractory material cut to required shapes for use in soaking pits, Bessemer converters, blast furnace ladles, mixers, gray iron ladles, foundry crane ladles, malleable furnaces, drop forge furnaces and other equipment.

5. Vibrating Screens

Robins Conveyors Div., Hewitt-Robins Inc.—4-page illustrated folder No. 122-A presents information on style M Vibrex vibratory screen. Stroke is adjustable, and unit can be either floor or suspension mounted. Applications and full range of sizes in single or double deck styles are included.

6. Core Machine

Stratton Mfg. Co.—6-page illustrated bulletin No. 101 presents description of Quickdraw core machine used for production of hand-made cores with machine-made speed and accuracy.

7. Single Surface Planers

Buss Machine Works—12-page illustrated bulletin No. 52 describes Buss Nos. 44 and 66 single surface wood planers. Features include large diameter cutter head that is vibrationless at all speeds, sectionally ventilated chip breaker, sectional infeed rolls, pressure bar with independent end adjustment and positive feed that prevents marking and burning.

8. Fire Clays

Illinois Clay Products Co.—4-page illustrated folder "Service to Industry" outlines company's service to foundries, steel plants and industry in general. Such materials as Therm-O-Flake packing, Goose Lake and Pedro tap hole clays, and numerous other products are described.

9. Three-Flute End Mills

Cadillac Cutter Co.—2-page illustrated data sheet and price list covers line of double-end three-flute end mills in from ⅛ to ½-inch mill diameters. Mills are said to 'hog' metal in same manner as two-flute tool and leave finish comparable to that left by four-flute tool.

10. Core Lubricant

Werner G. Smith Co.—6-page illustrated folder "Linoil Research Helps Make Better Cores" utilizes graph forms to present results of recent studies in five interesting problems common to all foundries. Graphs indicate how baking temperature, moisture content, silica flour and iron oxide, and cereal binders affect tensile strength of baked cores.

11. Carbon Control Equipment

Harry W. Dietert Co.—Illustrated data sheet "Carbon Control" outlines construction and operating features of an improved carbon determinator which provides easy method for making either preliminary or final carbon tests on all metals and organic or inorganic materials.

12. Materials Handling

Mercury Mfg. Co.—52-page illustrated comprehensive catalog No. 7-11, second edition, describes and gives specifications and applications of fork trucks, lift trucks, tractors and trailers. "Trackless Train" system of materials handling is explained in detail.

13. Core Blower

Champion Foundry & Machine Co.—8-page illustrated bulletin describes Junior core blower No. CB-5 designed for use by small foundries. Other foundry equipment including large core blowers, portable jolt squeeze, hand rollover and draw machine, jolt squeeze pin lift and stationary jolt squeeze machines are described also.

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14. Pneumatic Tools

Master Pneumatic Tool Co.—28-page illustrated loose-leaf general catalog contains complete information on applications, features and specifications of line of Master Power pneumatic tools. Tools include chipping and scaling hammers, sand rammers, grinders, wire brushing tools, buffers and sanders.

15. Self-Dumping Hoppers

Roura Iron Works—4-page illustrated folder "In Dollars and Sense" explains operating principles of self-dumping hoppers and how they can be utilized to meet individual requirements. Units can be attached to industrial trucks for bulk handling of almost every nature. Side dumping units and many special models are shown.

16. Hydraulic Presses

Hydraulic Press Mfg. Co.—8-page illustrated catalog "Quick Delivery New Equipment Stock List" covers line of H-P-M stock presses; metal working presses; diecasting machines; plastic molding machines; rubber molding machines; laboratory presses; and hydraulic pumps, valves and controls.

17. Single Stroke Lift Truck

LYON-Raymond Corp.—2-page illustrated bulletin No. 211 describes 2500-pound capacity, single stroke, lift truck available in varying heights and platform sizes. Truck features operating safety and light weight.

18. Surface Grinders

Peterson Welding Laboratories—4-page illustrated folder "Peterson Surface Grinder" is descriptive of model No. 48-A surface grinder which can be operated even by unskilled operators. Flat surface castings can be ground accurately to within 0.001-inch. Technical section deals with mounting instructions, procedures for fast cutting, accuracy and operating characteristics.

19. Lifting & Pulling Device

Coffing Hoist Co.—4-page illustrated folder "It Pulls! It Lifts! It Does Just About Anything" describes Hoist-Jack unit as fully portable and suited to use in factories, shops, mines and on construction jobs.

20. Industrial Power Trucks

Elwell-Parker Electric Co.—12-page illustrated bulletin form No. A-9516-31047 contains data on materials handling by use of industrial power trucks in numerous types of plants. Master Unit Load system is outlined.

21. Aluminum Foundry Flask

C. S. Humphrey Co. — Illustrated information sheet presents features of all-aluminum Flexo-Flask available in wide range of sizes. Copes and drags fit together in innumerable combinations to accommodate wide variety of sizes of molds. Light weight and assembly with common wrench are features.

22. Metal Alloying Material

General Cerium Co.—4-page illustrated bulletin No. 101 covers description and applications of Cerium metal which oxidizes rapidly and serves as good reducing agent. Exothermic characteristics of metal appreciably prolong fluidity of molten metals. It can be used to advantage in aluminum, magnesium, bronze, copper and iron castings.

23. Sealed Pipe Conveyors

Hapman Conveyors, Inc.—39-page illustrated catalog No. 4748 deals with pipe type conveyors and accessories. Included are engineering drawings of typical systems for handling sand, dust, chips, sludge and coal.

24. Cupola Blowers

Roots-Connersville Blower Corp.—8-page illustrated bulletin No. 120-23-B11 describes rotary and centrifugal cupola blowers for foundry cupolas. Comparison of two types and recommended applications are covered. Engineering data for use by foundrymen are included.

25. Blast Cleaning Abrasive

Cleveland Metal Abrasive Co.—8-page illustrated bulletin No. 48 describes 20th Century blast cleaning shot and grit abrasive scientifically heat treated to produce maximum cleaning results. It features uniformity in screen sizes and chemical analysis.

26. Industrial Belting

Imperial Belting Co.—4-page illustrated bulletin No. 48-1A describes ten types of Inner-Locked belting for materials handling and power transmission. Belts are of double-stitched woven duck construction specially impregnated to meet individual job requirements.

27. Industrial Trucks

Clark Equipment Co., Tructractor Div.—40-page illustrated catalog "Gas and Electric Fork Trucks and Industrial Towing Tractors" presents data on full line of machines and special materials handling attachments. Emphasis is placed on Pul-Pac unit which handles loads based on sheets of corrugated paper, and Hi-Lo-Stack truck which combines 130-inch lift, 83-inch overall height and 62-inch free lift.

28. Welding Electrodes

International Nickel Co.—4-page illustrated folder "For Machinable Welds in Cast Iron" cites uses of Ni-Rod welding electrodes for production, maintenance and casting salvage welding. Three examples of application are given.

29. Die Coatings

G. W. Smith & Sons, Inc.—4-page illustrated folder "Die Slick" outlines general properties and advantages gained through use of Die Slick which is available in four grades. Publication recommends specific grades to be used in producing zinc, aluminum, magnesium, brass or lead diecastings.

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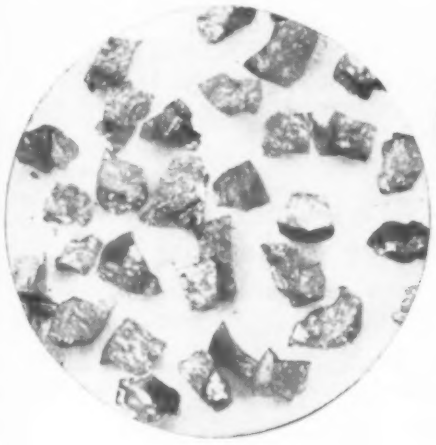

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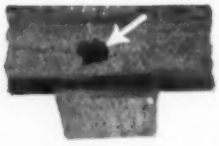

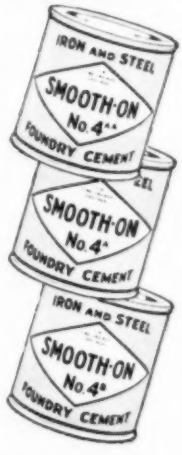

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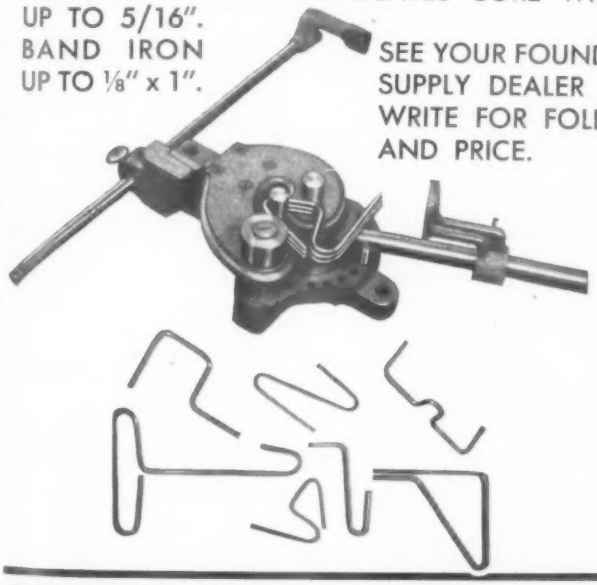

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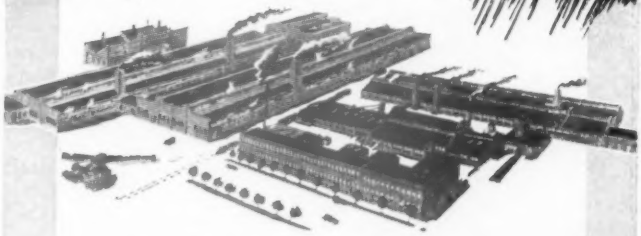

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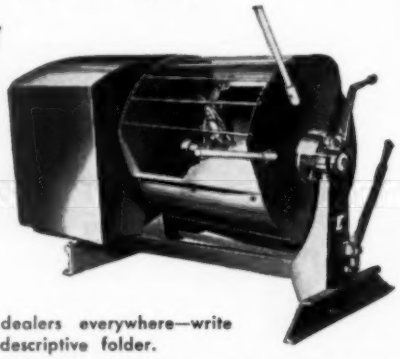

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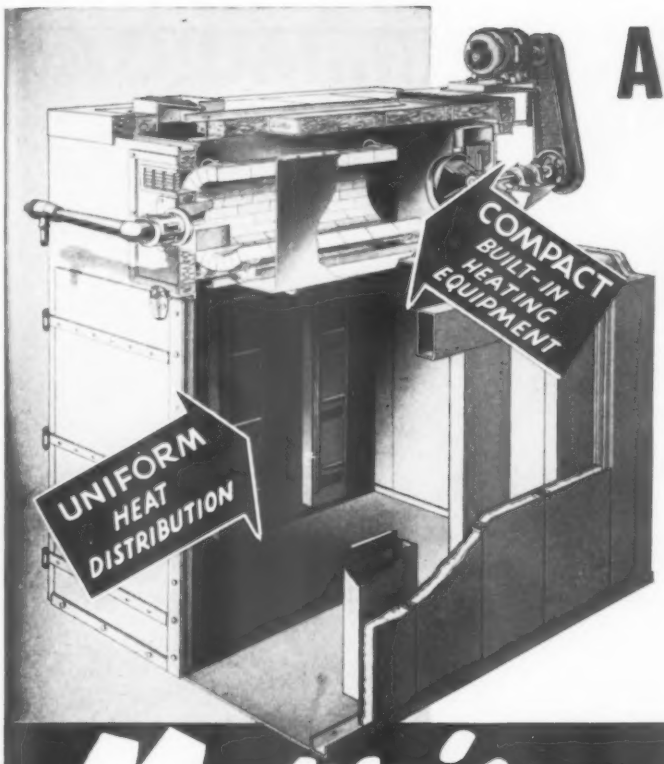

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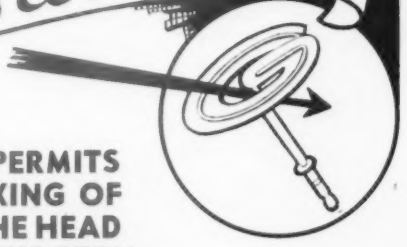

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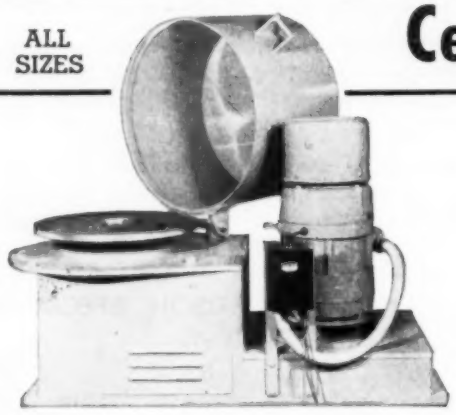

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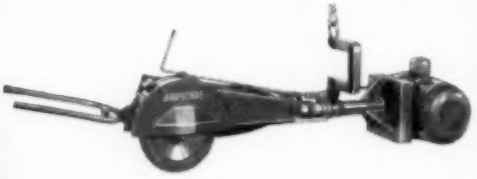

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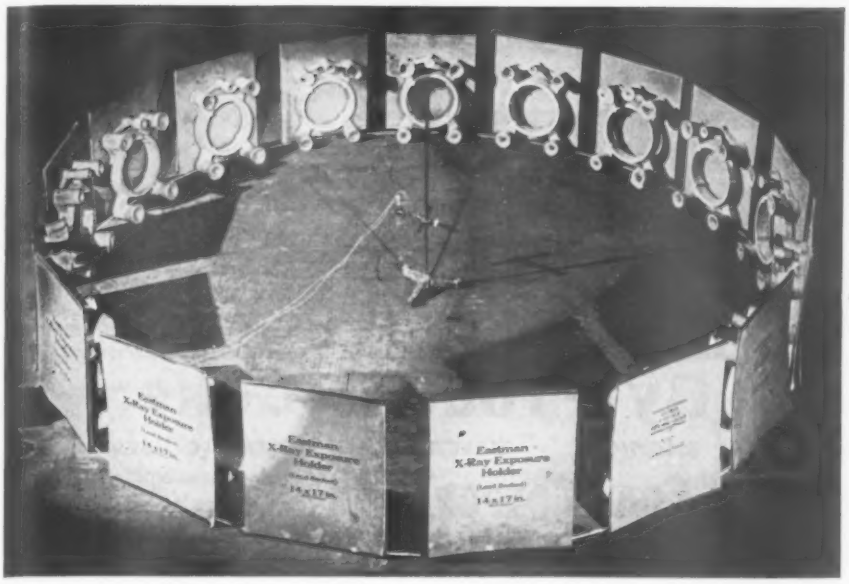

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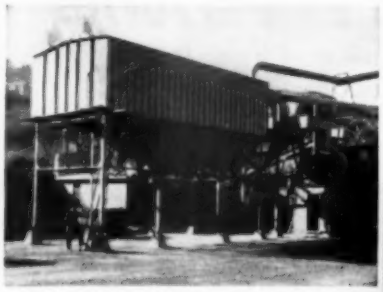

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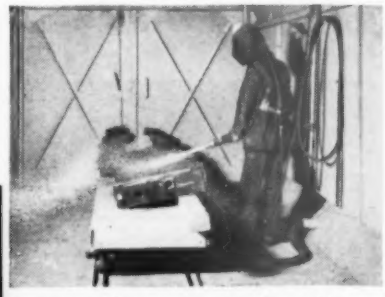

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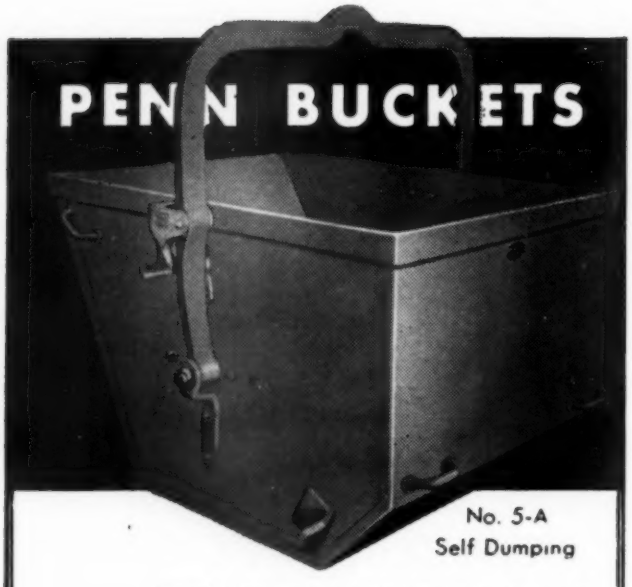

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Swan-Finch Oil Corp., R. C. A. Bldg., West, New York 26, N. Y.
Frederic B. Stevens, Inc., Detroit 16, Mich.
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United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
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International Molding Machine Co., 2608 W. 16th St., Chicago 8, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Randall Foundry Equipment Corp., 4600 E. 71st St., Cleveland 5, O.
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Diamond Clamp & Flask Co., Richmond, Ind.
Industrial Pattern Works, 2621 Belmont Ave., Chicago 18, Ill.
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CORE BOX VISES

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CORE BREAKERS

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CORE COLORING

Eaton Chemical & Dyestuff Co., 1490 Franklin, Detroit, Mich.

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Delta Oil Products Co., Milwaukee 9, Wis.
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E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
International Paper Co., 220 E. 42nd St., New York 17, N. Y.
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Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis.

CORE KNOCKOUT MACHINES

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
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Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., 2608 W. 16th St., Chicago 8, Ill.
Milwaukee Foundry Equipment Co., 3228 W. Pierce St., Milwaukee 4, Wis.
Randall Foundry Equipment Corp., 4600 E. 71st St., Cleveland 5, O.
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Werner G. Smith Co., 2191 W. 110th St., Cleveland 2, O.
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Haynes Foundry Equipment Co., 1734 Lake St., Kalamazoo 21, Mich.
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Ross Engineering Corp., J. O., 350 Madison Ave., New York 17, N.Y.
Young Brothers Co., 6508 Mack Ave., Detroit 7, Mich.

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Dayton Oil Co., Dayton 1, Ohio.
Delta Oil Products Co., Milwaukee 9, Wis.
Eastern Clay Products Co., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE PLATES (Magnesium)

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CORE PLATES (Steel, Asbestos)

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Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
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CORE WIRE STRAIGHTENERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
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CRANES (Electric Traveling)

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Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Northern Engineering Works, 2615 Atwater, Detroit 7, Mich.
Reading Chain & Block Corp., 2108 Adams St., Reading, Pa.
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Northern Engineering Works, 2615 Atwater, Detroit 7, Mich.
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Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
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Reading Chain & Block Corp., 2108 Adams St., Reading, Pa.
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Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
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Foxboro Company, Foxboro, Mass.

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Modern Equipment Co., Port Washington, Wis.
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FLASK BUSHINGS

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Universal Engineering Co., Frankenmuth, Mich.

FLASK PINS

Diamond Clamp & Flask Co., Richmond, Ind.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Universal Engineering Co., Frankenmuth, Mich.

FLASKS (Aluminum)

Adams Co., Dubuque, Iowa.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASKS (Dowmetal)

Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASK FILLERS

Bartlett & Snow, C. C., Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., Columbus 16, O.

FLASKS (Slip)

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., Fremont, O.
Freeman Supply Co., Toledo 5, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

FLASKS (Snap)

Adams Co., Dubuque, Iowa.
Arcade Manufacturing Div. Rockwell Mfg. Co., Freeport, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Stevens, Inc., Frederic B., Detroit 16, Mich.

FLASKS (Steel)

Black, Sivalls & Bryson, Inc., 720 Delaware, Kansas City 6, Mo.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Shanafelt Mfg. Co., 2623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

FLASK FITTINGS

Adams Co., Dubuque, Iowa.
Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.
Diamond Clamp & Flask Co., Richmond, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

FLASK FITTINGS (Cont'd.)

Shanafelt Mfg. Co., 3623 Winfield Way, N.E., Canton 5, Ohio.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

FLASK LIFT MACHINES

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.

FLASK LUMBER

Dougherty Lumber Co., 4300 E. 66th St., Cleveland 5, O.

FLASKS (Wood)

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.

FLEXIBLE SHAFT MACHINERY

Strand Co., N. A., 5001 N. Wolcott Ave., Chicago 40, Ill.

FLOORING (Non-Slip)

Norton Co., Worcester 6, Mass.

FLUXES

American-British Chemical Supplies Inc., 180 Madison Ave., New York 16, N. Y.
Atlantic Chemical & Metals Co., 1925 N. Kenmore, Chicago 14, Ill.
Carbon Limestone Co., Youngstown, Ohio.
Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Foundry Services, Inc., 280 Madison Ave., New York 16, N. Y.
Mathieson Chemical Corp., 60 E. 42nd St., New York 17, N. Y.
National Pigment Co., East York St., Philadelphia, Pa.
Niagara Falls Smelting & Refining Corp., 2204 Elmwood Ave., Buffalo 17, N. Y.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
Rossborough Supply Co., 1456 W. 9th St., Cleveland 13, O.
Thiem Products Co., 647 East Virginia St., Milwaukee 4, Wis.

FLUXES (Soldering, Welding & Tinning)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

FOUNDRY ENGINEERS

Aimes Co., Inc., 2424 Euclid Ave., Cleveland, Ohio.

FOUNDRY LAYOUT & METHODS

Frank D. Campbell, 332 So. Michigan Ave. Chicago, Ill.
Conover Engineering Co., 1740 East 12th St., Cleveland 14, Ohio.
Engineering Service Inc., 610 West Michigan St., Milwaukee 3, Wis.
Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.
Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.
Reichert Engineering Co., W. G., 1060 Broad St., Newark, New Jersey.

FOUNDRY NAILS

Standard Horse Nail Corp., New Brighton, Pa.

FOUNDRY SHOVELS
(See SHOVELS)

FOUNDRY SUPPLIES

Rossborough Supply Co., 1456 W. 9th St., Cleveland 13, O.

FOUNDRY SUPPLY HOUSES

Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7, N. Y.
Eastern Clay Products, Inc., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O
Foundries Materials Co., Coldwater, Mich.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, O.
Pennsylvania Foundry Supply & Sand Co., Ashland & E. Lewis Sts., Philadelphia 24, Pa.
Stevens, Inc., Frederic B., Detroit 16, Mich.

FOUNDRY SYSTEMS

Engineering Seervice Inc., 610 West Michigan St., Milwaukee 3, Wis.
Reichert Engineering Co., W. G., 1060 Broad St., Newark, New Jersey.

FURNACES (Aluminum & Magnesium Billets)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

FURNACES (Aluminum & Magnesium Forgings)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 ColumbusRd., Cleveland 13, Ohio.

FURNACES (Aluminum Melting)

Ajax Engineering Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Surface Combustion Corp., Toledo 7, Ohio
Wilson Industries, 38 Memorial Dr., Cambridge 42, Mass.

FURNACES (Aluminum Rivet Heating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Despatch Oven Co., Minnesapolis 14, Minn.

FURNACES (Annealing)

Campbell-Hausfeld Co., Harrison, Ohio.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Johnston Mfg. Co., Minneapolis 13, Minn.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Crucible Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
Campbell-Hausfeld Co., 300-320 Moore St., Harrison, O.
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Johnston Mfg. Co., Minneapolis 13, Minn.
Randall Foundry Equipment Corp., 4600 E. 71st St., Cleveland 5, O.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

FURNACES (Electric Melting)

Ajax Electric Furnace Corp., 46 Richmond St., Philadelphia 23, Pa.

FURNACES (Electric Melting) (Cont'd.)

Philadelphia 23, Pa.
Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Greene Electric Furnace Co., 2702 6th So., Seattle 4, Wash.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Gas or Oil Fired)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Denver Fire Clay Co., 2301 Blake St., Denver, Colo.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Johnston Mfg. Co., Minneapolis 13, Minn.
Lanly Company, 750 Prospect Ave., Cleveland 15, Ohio.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
Randall Foundry Equipment Corp., 4600 E. 71st St., Cleveland 5, O.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.
Wilson Industries, 38 Memorial Dr., Cambridge 42, Mass.

FURNACES (Gray Iron Melting)

American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.
Wilson Industries, 38 Memorial Dr., Cambridge 42, Mass.

FURNACES (Heat Treating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Johnston Mfg. Co., Minneapolis 13, Minn.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

FURNACES, HEAT TREATING (Electric)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Trenton, N. J.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.

FURNACES (Malleable Annealing)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.

FURNACES (Malleable Annealing) (Cont'd.)

Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.
Young Brothers Co., 6508 Mack Ave., Detroit 7, Mich.

FURNACES (Malleable Melting)

American Bridge Co., Pittsburgh 19, Pa.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Nonferrous Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
Campbell-Hausfeld Co., Harrison, O.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Johnston Mfg. Co., Minneapolis 13, Minn.
Randall Foundry Equipment Corp., 4600 E. 71st St., Cleveland 5, O.
Stroman Furnace & Engineering Co., Div of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.
Surface Combustion Corp., Toledo 7, Ohio
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.
Wilson Industries, 38 Memorial Dr., Cambridge 42, Mass.

FURNACES (Powdered Coal)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Steel Melting)

Ajax Electrothermic Corp., Trenton, N. J.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACE BLOWERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Roots-Connersville Blower Corp., Connersville, Ind.

FURNACE BOTTOMS

Industrial Silica Corp., Stambaugh Bldg., Youngstown, O.

FURNACE LININGS

Campbell-Hausfeld Co., Harrison, O.
Carborundum Co., Perth Amboy, N. J.
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Ironton Fire Brick Co., Ironton, O.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.
United States Graphite Co., Saginaw, Mich.

GAGES

Acme Aluminum Alloys Inc., Dayton 3, Ohio.
Master Pattern Co., 1315 Main Ave., Cleveland, Ohio.

GAGGERS

Federal Foundry Supply Co., 4600 E. 71st Cleveland 5, O.

GAS

American Gas Association, 420 Lexington Ave., New York 17, N. Y.

GAS BURNERS

Fisher Furnace Co., 2543 West Hubbard St., Chicago 12, Ill.
North American Mfg. Co., 4455 E. 71st St., Cleveland 4, O.

GENERATORS (Acetylene)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

GLOVES (Industrial, Safety)

American Optical Co., Southbridge, Mass.
C. Walker Jones Co., 6135 Lambert St., Philadelphia 38, Pa.

GOGGLES and EYE PROTECTORS

American Optical Co., Southbridge, Mass.
Chicago Eye Shield Co., 2300 West Warren, Chicago 12, Ill.
Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.
Willson Products Inc., Reading, Pa.

GRAPHITE

Acheson Colloids Corp., Port Huron, Mich.
Asbury Graphite Mills, Asbury, N.J.
Bloomsbury Graphite Co., Bloomsbury, N. J.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
International Graphite & Electrode Corp., St. Marys, Pa.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17.
Superior Flake Graphite Co., 33 S. Clark St., Chicago 3, Ill.
United States Graphite Co., Saginaw, Mich.

GRINDERS (Electric Portable)

Chicago Pneumatic Tool Co., 8 East 44th St., New York 17.
Independent Pneumatic Tool Co., Aurora, Ill.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Skilsaw, Inc., 5000 N. Elston, Chicago 30, Ill.
Standard Electrical Tool Co., 2488 Riverside Ave., Cincinnati 4, Ohio.
U. S. Electrical Tool Co., Cincinnati 4, O.

GRINDERS (Flexible Shaft)

N. A. Strand Co., 5001 N. Wolcott Ave., Chicago 40, Ill.

GRINDERS (Pneumatic Portable)

Chicago Pneumatic Tool Co., 8 East 44th St., New York 17.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Independent Pneumatic Tool Co., Aurora, Ill.
Master Pneumatic Tool Co., Inc., Keith Bldg., Cleveland, Ohio.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.

GRINDERS (Surface, Bench, Disc, Floor)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Independent Pneumatic Tool Co., Aurora, Ill.
Skilsaw, Inc., 5000 N. Elston, Chicago 30, Ill.

GRINDERS (Surface, Bench, Disc, Floor) (Cont'd.)

Standard Electrical Tool Co., 2488 Riverside Ave., Cincinnati 4, Ohio.
N. A. Strand Co., 5001 N. Wolcott Ave., Chicago 40, Ill.
U. S. Electrical Tool Co., Cincinnati 4, O.
Vonnegut Moulder Corp., 1815 Madison Ave., Indianapolis 2, Ind.

GRINDERS (Swing Frame)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Vonnegut Moulder Corp., 1815 Madison Ave., Indianapolis 2, Ind.

GRINDING WHEELS—See ABRASIVE WHEELS

GRINDING WHEEL DRESSERS

Carborundum Co., Niagara Falls, N. Y.
Desmond-Stephan Mfg. Co., Urbana, O.
Vincent Steel Process Co., 2424 Bellevue St., Detroit 7, Mich.

GRINDSTONES

Bay State Abrasive Products Co., Westboro, Mass.
Sterling Grinding Wheel Div. Cleveland Quarries Co. 1740 E. 12th St., Cleveland, O.

GRIT (Abrasive)

Alloy Metal Abrasive Co., Ann Arbor, Mich.
American Steel Abrasives Co., Galion, O.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Carborundum Co., Niagara Falls, N. Y.
Clayton Sherman Abrasives Co., 3896 Lonyo Rd., Detroit 10, Mich.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Globe Steel Abrasive Co., Mansfield, O.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
National Metal Abrasive Co., 3560 Norton Ave., Cleveland 7, O.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.

HAMMERS (Chipping)

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Chicago Pneumatic Tool Co., 8 East 44th St., New York 17.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, Ohio
Dallett Co., 165 West Clearfield, Philadelphia, Pa.
Independent Pneumatic Tool Co., Aurora, Ill.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Master Pneumatic Tool Co., Inc., Keith Bldg., Cleveland, Ohio.
Schramm Inc., West Chester, Pa.

HARDNESS TESTING EQUIPMENT

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.

HEAT CONTROL AND RECORDING DEVICES

Brown Instrument Co. Div. Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Foxboro Company, Foxboro, Mass.
Claude S. Gordon Co., 300 So. Wallace, Chicago 9, Ill.
Illinois Testing Laboratories, 418 N. LaSalle St., Chicago 10, Ill.

HEAT CONTROL AND RECORDING DEVICES (Cont'd.)

Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.

HEATERS (Gas, Oil, Electric)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Despatch Oven Co., Minneapolis 14, Minn.
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.
Ross Engineering Corp., J. O., 350 Madison Ave., New York 17, N.Y.

HEATERS (High Frequency Electric)

Ajax Electrothermic Corp., Trenton, N. J.

HEATERS (Indirect Fired)

Despatch Oven Co., Minneapolis 14, Minn.

HEATERS (Space, Unit, Direct Fired)

Dravo Corp., Dravo Bldg., Pittsburgh 22, Pa.
Newcomb-Detroit Co., Inc., 5741 Russell St., Detroit 11, Mich.

HEATERS (Space, Unit, Oven, Water)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Westinghouse Electric Corp., B. F. Sturtevant Div., 40 Wall St., New York 4, N. Y.

HELMETS (Blasting)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Optical Co., Southbridge, Mass.
Mine Safety Appliance Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, O.

HELMETS (Welding)

American Optical Co., Southbridge, Mass.

HOISTS (Air)

Chicago Pneumatic Tool Co., 8 East 44th St., New York 17.
Curtis Pneumatic Machinery Co., 1922 Kienlen Ave., St. Louis 20, Mo.
Gardner-Denver Co., Quincy, Ill.
Independent Pneumatic Tool Co., Aurora, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.

HOISTS (Chain)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Reading Chain & Block Corp., 2108 Adams St., Reading, Pa.

HOISTS (Electric)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Conco Engineering Works, Mendota, Illinois.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Modern Equipment Co., Port Washington, Wis.
Reading Chain & Block Corp., 2108 Adams St., Reading, Pa.
Robbins & Myers, Inc., Springfield, Ohio.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.

HOISTS (Electric) (Cont'd.)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

HOISTS (Hand)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.

HOSE (Air, Blasting, Water, Gas)

Gardner-Denver Co., Quincy, Ill.
Independent Pneumatic Tool Co., Aurora, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Pangborn Corp., Hagerstown, Md.
Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J.
Schramm Inc., West Chester, Pa.

HYDRAULIC CLEANING EQUIPMENT

Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Pangborn Corp., Hagerstown, Md.
N. Ransohoff Inc., 208 W. 71st St., Cincinnati 16, O.

ILLUMINATORS (X-Ray Film)

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 West McGeoch Ave., Milwaukee 14, Wis.

IMPREGNATING SYSTEMS

Empire Varnish Co., 2636 E. 76th St., Cleveland 4, O.

INDUSTRIAL ENGINEERING SERVICE

Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.
Reichert Engineering Co., W. G., 1060 Broad St., Newark, New Jersey.

INGOT MOLDS

Acme Foundry Co., Detroit 16, Mich.

INGOTS (Magnesium)

Christiansen Corp., 1515 No. Kilpatrick, Chicago 51, Ill.

INGOTS (Nonferrous)

Ajax Metal Co., Philadelphia 23, Pa.
American Smelting & Refining Co., 120 Broadway, New York 5.
Apex Smelting Co., 2534 Fillmore St., Chicago 12, Ill.
Christiansen Corp., 1515 No. Kilpatrick, Chicago 51, Ill.
Cleveland Electro Metals Co., W. 38th St. & NP RR. Cleveland 13, O.
Federated Metals Div., American Smelting & Ref. Co., New York 5.
International Nickel Co., Inc., 67 Wall St., New York City 5.
R. Lavin & Sons Inc., 3426 So. Kedzie Ave., Chicago 23, Ill.
Niagara Falls Smelting & Refining Corp., 2204 Elmwood Ave., Buffalo 17, N. Y.
Rossborough Supply Co., 1456 W. 9th St., Cleveland 13, O.
Silverstein & Pinsof, Inc., 1720 N. Elston, Chicago 22, Ill.
Sonken-Galamba Corp., Kansas City 18, Kansas.
U. S. Reduction Co., East Chicago, Ind.

INJECTION MOLDING MACHINES

Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.

INOCULANTS

Carborundum Co., Perth Amboy, N. J.

INSULATORS (for Castings heads)

E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

IRON CEMENT

Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City 4, N. J.

IRON ORE

Bethlehem Steel Co., Bethlehem, Pa.
Pickands, Mather & Co., Cleveland 14, O.

IRON OXIDES

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.

JACKETS (Mold)

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

LABORATORY EQUIPMENT (Chemical)

Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
General Electric X-Ray Corp., 4855 West McGeoch Ave., Milwaukee 14, Wis.

LABORATORY EQUIPMENT (Physical)

W. C. Dillon & Co. Inc., 5410 W. Harrison St., Chicago 44, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
General Electric X-Ray Corp., 4855 West McGeoch Ave., Milwaukee 14, Wis.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Norton Co., Worcester 6, Mass.

LADLES

Bethlehem Steel Co., Bethlehem, Pa.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Industrial Equipment Co., Minster, O.
Modern Equipment Co., Port Washington, Wis.
Frederic B. Stevens, Inc., Detroit 16, Mich.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

LADLE HEATERS

Whiting Corp. 15607 Lathrop Ave., Harvey, Ill.

LADLE LININGS

Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Ironton Fire Brick Co., Ironton, Ohio.

LATHE CENTERS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

LEAD

American Smelting & Refining Co., 120 Broadway, New York 5.

LIMESTONE

Carbon Limestone Co., Youngstown, Ohio.

LINSEED OIL

Hercules Powder Co., Wilmington 99, Del.

LOADERS

Clearfield Machine Co., Clearfield, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

LUBRICANTS (Industrial)

Acheson Colloids Corp., Port Huron, Mich.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Swan-Finch Oil Corp., R. C. A. Bldg., West, New York 26, N. Y.
United States Graphite Co., Saginaw, Mich.

LUMBER (All kinds)

Dougherty Lumber Co., 4300 East 68th St., Cleveland 5, O.

MACHINE KEYS

Standard Horse Nail Corp., New Brighton, Pa.

MACHINERY MOUNTING PADS

Fabreeka Products, Inc., 222B Summer St., Boston, Mass.

MAGNESIUM (Ingots)

Apex Smelting Co., 2534 Filmore St., Chicago 12, Ill.

MAGNET CONTROLLERS

Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.

MAGNETS

Dings Magnetic Separator Co., 4740 W. McGeough, Milwaukee 7, Wis.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

MANGANESE (Briquets)

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York 17, N. Y.

MARKER (Castings)

Markal Co., 607 No. Western Ave., Chicago 12, Ill.

MATCHPLATES

Acme Aluminum Alloys Inc., 232 North Findlay St., Dayton 3, Ohio.
Champion Foundry & Machine Co., 1553 West Madison St., Chicago 7, Ill.
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Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.

SAND BLAST TABLES

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.

SAND CONDITIONERS

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.

SAND CONTROL & TESTING EQUIPMENT

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND CONVEYING and HANDLING EQUIPMENT

American Air Filter Co., Louisville 8, Ky.
Ajax Flexible Coupling Co., Westfield, N. Y.
C. O. Bartlett & Snow Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Chain Belt Co., 1671 W. Bruce St., Milwaukee 4, Wis.
Clearfield Machine Co., Clearfield, Pa.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.

SAND CONVEYING and HANDLING EQUIPMENT (Cont'd)

Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Penn Iron Works, Reading, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

SAND CONVEYING and HANDLING EQUIPMENT (Pneumatic)

Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.
Fuller Company, Catasauqua, Pa.
Frank G. Hough Co., Libertyville, Ill.
Robins Conveyors Inc., 70 Pine St., New York 5, N. Y.

SAND COOLING SYSTEMS

Newaygo Engineering Co., Newaygo, Mich.

SAND DRYERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Nichols Engineering & Research Corp., 60 Wall Tower, New York 5, N. Y.

SANDERS (Tapered-Spindles)

Wellman Products Co., 1444 E. 49th St., Cleveland 3, O.

SANDING MACHINERY (Disc, Spindle, Belt, etc.)

Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Oliver Machinery Company, Grand Rapids 2, Mich.

SAND MEASURING and WEIGHING DEVICES

Baker Perkins Inc., Saginaw, Mich.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND MIXERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.
Blystone Division, Standard Sand & Machine Co., 549 W. Washington Blvd., Chicago 6, Ill.
Clearfield Machine Co., Clearfield, Pa.
Construction Machinery Corp., Waterloo, Iowa.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Lancaster Iron Works, Lancaster, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.

SAND PREPARATION EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Ajax Flexible Coupling Co., Westfield, N. Y.
Baker Perkins Inc., Saginaw, Mich.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Clearfield Machine Co., Clearfield, Pa.

SAND PREPARATION EQUIPMENT (Cont'd.)

Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Lancaster Iron Works, Lancaster, Pa.
Moulders Friend, Dallas City, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Royer Foundry & Machine Co., Kingston, Pa.
Screen Equipment Co., Buffalo 21, N. Y.
Simplicity Engineering Co., Durand, Mich.

SAND RAMMERS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Master Pneumatic Tool Co., Inc., Keith Bldg., Cleveland, Ohio.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.

SAND RECLAIMERS

Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Nichols Engineering & Research Corp., 60 Wall Tower, New York 5, N. Y.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

SAND SIFTING and SCREENING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Air Filter Co., Louisville 8, Ky.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, Ohio.
Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Champion Foundry & Machine Co., 1553 West Madison St., Chicago 7, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Great Western Mfg. Co., Leavenworth, Kansas.
Link Belt Co., 300 W. Pershing Rd., Chciago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.
Screen Equipment Co., Buffalo 21, N. Y.
Simplicity Engineering Co., Durand, Mich.
Pangborn Corp., Hagerstown, Md.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

SAND STORAGE BINS & GATES

Bartlett & Snow, C. O., Co., 601 Harvard Ave., Cleveland 5, Ohio.
Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Neff & Fry Co., Camden, O.

SANDING MACHINERY (Electric Portable)

Skilsaw, Inc., 5000 N. Elston, Chicago 30, Ill.

SAWS (Band, Metal, Wood)

Atlantic Saw Mfg. Co., New Haven, Conn.
Do All Company, Des Plaines, Ill.
Oliver Machinery Company, Grand Rapids 2, Mich.
Parks Woodworking Machine Co., 1546 Knowlton St., Cincinnati 23, Ohio.

SAWS (Cold Metal)

Bethlehem Steel Co., Bethlehem, Pa.
Do All Company, Des Plaines, Ill.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

SAWS (Electric Portable)

Skilsaw, Inc., 5000 N. Elston, Chicago 30, Ill.

SCALING HAMMERS

Dallett Co., 165 West Clearfield, Philadelphia, Pa.
Independent Pneumatic Tool Co., Aurora, Ill.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Schramm, Inc., West Chester, Pa.

SCRAP

Alter Company, 1702 Rockingham Rd., Davenport, Iowa.

SCREENS (Shake-Out)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
C. O. Barelett & Snow Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Screen Equipment Co., Buffalo 21, N. Y.
Simplicity Engineering Co., Durand, Mich.

SCREENS (Vibrating)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Ajax Flexible Coupling Co., Westfield, N. Y.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Robins Conveyors, Inc., 70 Pine St., New York 5, N. Y.
Screen Equipment Co., Buffalo 21, N. Y.
Simplicity Engineering Co., Durand, Mich.

SEA COAL

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.

SEPARATORS (Abrasive)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

SEPARATORS (Air, Moisture, Oil)

American Air Filter Co., Louisville 8, Ky.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Dollinger Corp., 36 Centre Park, Rochester 4, N. Y.
Jas. A. Murphy & Co., Hamilton, O.
Pangborn Corp., Hagerstown, Md.

SEPARATORS (Magnetic)

Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.
Dings Magnetic Mfg. Co., 4740 W. McGeough, Milwaukee 7, Wis.
National Engineering Co., 549 W. Washihtgon St., Chicago 6, Ill.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

SHAKE-OUT MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Air Filter Co., Louisville 8, Ky.
C. O. Bartlett & Snow Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.
Robins Conveyors, Inc., 70 Pine St., New York 5, N. Y.
Royer Foundry & Machine Co., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

SHAKEOUT MACHINE MOUNTING PADS

Fabreeka Products, Inc., 222B Summer St., Boston, Mass.

SHOCK ABSORBING PADS

Fabreeka Products, Inc., 222B Summer St., Boston, Mass.

SHOT AND GRIT

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Steel Abrasives Co., Galion, O.
Carpenter Brothers, Inc., 606 West Wisconsin, Milwaukee 3, Wis.
Clayton Sherman Abrasives Co., 3896 Lonyo Rd., Detroit 10, Mich.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Globe Steel Abrasive Co., Mansfield, O.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
National Metal Abrasive Co., 3560 Norton Ave., Cleveland 7, O.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.
Pennsylvania Foundry Supply & Sand Co., Ashland & E. Lewis Sts., Philadelphia 24, Pa.
George Pfaff Inc., 11-61 Jackson Ave., Long Island City, N. Y.
Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.
Steel Shot & Grit Co., Inc., 39 Warren Ave., Boston, Mass.

SHOT (Peening)

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Steel Abrasives Co., Galion, O.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Globe Steel Abrasive Co., Mansfield, Ohio.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
National Metal Abrasive Co., 3560 Norton Ave., Cleveland 7, O.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.
Steel Shot & Grit Co., Inc., 39 Warren Ave., Boston, Mass.

SHOVELS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.

SHOVELS (Power)

Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

SILICA FLOUR

Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

SILICOMANGANESE

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York 17, N. Y.

SILICON (Briquets)

Electro Metallurgical Sales Corp., 30 E. 42nd St., New Yorgk 17, N. Y.

SILICON CARBIDE (Briquets)

Carborundum Co., Perth Amboy, N. J.

SILVERY PIG IRON see Pig Iron (Silvery)

SKIMMER BARS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

SKIMMERS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Tamms Silica Co., 228 N. LaSalle St., Chicago 1, Ill.

SKIP HOISTS

Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Gardner-Denver Co., Quincy, Ill.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

SLIP FLASKS

Adams Co., Dubuque, Iowa.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

SLINGS (Chain)

Jeffrey Mfg. Co., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
S. G. Taylor Chain Co., Hammond, Ind.

SLIP JACKETS

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

SMELTERS & REFINERS

American Smelting & Refining Co., 120 Broadway, New York 5.
Christiansen Corp., 1515 No. Kilpatrick, Chicago 51, Ill.
R. Lavin & Sons Inc., 3426 S. Kedzie Ave., Chicago 23, Ill.
Niagara Falls Smelting & Refining Corp., 2204 Elmwood Ave., Buffalo 17, N. Y.

SNAGGING WHEELS—See ABRASIVE WHEELS

SNAP FLASKS

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

SODA ASH

Hercules Powder Co., Wilmington 99, Del.
Mathieson Chemical Corp., 60 E. 42nd St., New York 17, N. Y.

SOLDER

American Smelting & Refining Co., 120 Broadway, New York 5.

SPACE HEATERS

Dravo Corp., Dravo Bldg., Pittsburgh 22, Pa.

SPECIAL FOUNDRY ALLOYS

Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

SPRAY GUNS

Murphy & Co., Jas. A., Hamilton, O.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.

SPRUE CUTTERS

Adams Co., Dubuque, Iowa.
Milwaukee Chaplet & Mfg. Co., 1023 S. 40th St., Milwaukee, Wis.

STEEL (High Speed)

Bethlehem Steel Co., Bethlehem, Pa.

STEEL (Structural)

Alter Company, 1702 Rockingnam Rd., Davenport, Iowa.
American Bridge Co., Pittsburgh 19, Pa.

STRIPPING MACHINES

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1553 West Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
International Molding Machine Co., 2608 W. 16th St., Chicago 8, Ill.
Milwaukee Foundry Equipment Co., 3228 W. Pierce St., Milwaukee, Wis.

SURFACE TREATMENT METALS

N. Ransohoff, Inc., 208 W. 71st St., Cincinnati 16, O.

TAPER PINS

Standard Horse Nail Corp., New Brighton, Pa.

TEMPERATURE CONTROLLERS

Brown Instrument Co. Div. Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Foxboro Company, Foxboro, Mass.
Illinois Testing Laboratories, 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane Columbus 1, O.

TESTING EQUIPMENT

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.

TESTING LABORATORIES

Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.

TESTING MACHINERY

W. C. Dillon & Co. Inc., 5410 W. Harrison St., Chicago 44, Ill.

TESTING MACHINES (Tensile)

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.

THERMOCOUPLES

Brown Instrument Co. Div. Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Illinois Testing Laboratories, 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.
Pyrometer Instrument Co., Bergenfield, N. J.
Tamms Silica Co., 228 N. LaSalle St., Chicago 1, Ill.

TIERING MACHINES (Power)

Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

TIMERS (Electric)

Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.

TIN

American Smelting & Refining Co., 120 Broadway, New York 5. N.Y.

TONGS

Industrial Equipment Co., Minster, O.

TOOLS, CUTTING (Carbide)

Severance Tool Industries Inc., Saginaw, Mich.

TOOLS (Electric Portable)

Skilsaw, Inc., 5000 N. Elston, Chicago 30, Ill.

TOOLS (Pneumatic Portable)

Chicago Pneumatic Tool Co., 8 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, O.
Dallett Co., 165 West Clearfield, Philadelphia, Pa.
Gardner-Denver Co., Quincy, Ill.
Independent Pneumatic Tool Co., Aurora, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Schramm Inc., West Chester, Pa.

TORCHES and BURNERS (Acetylene, gas, oil)

Linde Air Products Co., 30 E. 42nd St., New York 17.
North American Mfg. Co., 4455 E. 71st St., Cleveland 4, O.

TOTE BOXES (see "BOXES-TOTE")

TRACTOR (Gas Powered)

Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

TRADE ASSOCIATIONS

Crucible Manufacturers Association, 90 West St., New York 6, N. Y.
Gray Iron Foundres Society Inc., 1010 Public Square Bldg., Cleveland 13, Ohio.

TRAMRAIL SYSTEMS

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Modern Equipment Co., Port Washington, Wis.

TROLLEYS

Curtis Pneumatic Machinery Co., 1922 Kienlen Ave., St. Louis 20, Mo.
Modern Equipment Co., Port Washington, Wis.

TRUCK BATTERIES (Industrial)

Electric Storage Battery Co., Allegheny Ave. at 19th St., Philadelphia 3, Pa.

TRUCK CRANES

Hughes-Keenan Co., Mansfield, Ohio.
Silent Hoist & Crane Co., 885 63rd St., Brooklyn 20, N. Y.

TRUCK WHEELS

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

TRUCKS (Core Oven)

Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

TRUCKS (Power Lift)

Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

TUBES (Annealing)

Pressed Steel Co., Wilkes-Barre, Pa.

TUBES (X-Ray)

General Electric X-Ray Corp., 4855 West McGeoch Ave., Milwaukee 14, Wis.

TUMBLING BARRELS

Cleveland Chaplet & Mfg. Co., 1197 West 67th St., Cleveland 2, O.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
N. Ransohoff Inc., 208 W. 71st St., Cincinnati 16, O.
Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

TURNTABLES

Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Modern Equipment Co., Port Washington, Wis.
Newaygo Engineering Co., Newaygo, Mich.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

UNIT HEATERS

Dravo Corp., Dravo Bldg., Pittsburgh 22, Pa.

UNLOADERS (Portable-Gas Electric)

Cleveland Formgrader Co., 6723 Denison Ave., Cleveland, Ohio.

VALVES (Air, Water, Steam)

Air-Way Pump & Equipment Co., 1050 N. Kilbourn, Chicago, Ill.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Dallett Co., 165 West Clearfield, Philadelphia, Pa.
North American Mfg. Co., 4455 E. 71st St., Cleveland 4, O.

VALVES (Adjustable Orifice)

North American Mfg. Co., 4455 E. 71st St., Cleveland 4, Ohio.

VALVES (Blow-off and Cut-off)

Champion Foundry & Machine Co., 1553 West Madison St., Chicago 7, Ill.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Wm. H. Nichols Co., Richmond Hill, Long Island 18, N. Y.

VALVES (Oxygen, Acetylene)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

VENTILATORS (Roof)

Swartwout Co., 18511 Euclid Ave., Cleveland 15, Ohio.

VENTILATING SYSTEMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Newcomb-Detroit Co., Inc., 5741 Russell St., Detroit 11, Mich.
Pangborn Corp., Hagerstown, Md.
Propellair Inc., Springfield, Ohio.
Ross Engineering Corp., J. O., 350 Madison Ave., New York 17, N.Y.
Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.
Swartwout Co., 18511 Euclid Ave., Cleveland 15, Ohio.

VENTILATING SYSTEMS (Cont'd.)

W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, O.
Westinghouse Electric Corp., B. F. Sturtevant Div., 40 Wall St., New York 4, N. Y.

VENTS (Core Box)

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Demmler & Bros., Wm., Kewanee, Ill.
C. M. Smillie & Co., 1100 Woodward Hgts. Blvd., Ferndale, Mich.
Landis Mfg. Co., 2305 Hilton Rd., Ferndale, Mich.

VIBRATION REDUCTION PADS

Fabreeka Products, Inc., 222B Summer St., Boston, Mass.

VIBRATORS

Adams Co., Dubuque, Iowa.
Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Cannon Vibrator Co., 111 Power Ave., Cleveland 14, Ohio.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Davenport Machine & Foundry Co., Davenport, Iowa.
Dallett Co., 165 West Clearfield, Philadelphia, Pa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.
Nichols Co., Wm. H., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S P O Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Syntron Company, Homer City, Pa.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

VIBRATORS (Core Bench)

Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.

WASH ROOM EQUIPMENT

Bradley Washfountain Co., Box 732, Milwaukee 1, Wis.

WATER COOLERS (Electric)

Ebco Mfg. Co., 401 W. Town St., Columbus 8, Ohio.

WAX (Core, Vent, Pattern)

United Compound Co., Inc., 328 South Park Ave., Buffalo 4, N. Y.

WAX (Precision Casting)

Halowax Products Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

WEDGES (Foundry)

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

WELDING GAS

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

WELDING APPARATUS (Electric Arc)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Lide Air Products Co., 30 E. 42nd St., New York 17, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

WELDING and CUTTING APPARATUS and SUPPLIES

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

WELDING ELECTRODES (Carbon)

National Carbon Co., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.

WELDING RODS & ELECTRODES

International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

WHEELBARROWS

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

WHEELS, ABRASIVE (Cut-off)

Bay State Abrasive Products Co., Westboro, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Stratford, Conn.
Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Independent Pneumatic Tool Co., Aurora, Ill.
Norton Company, Worcester 6, Mass.
Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit, Mich.
Raybestos Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Sterling Grinding Wheel Division, Cleveland Quarries Co., Tiffin, Ohio.

WHEELS (Wire)

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.

WIRE BENDERS

Redford Iron & Equipment Co., 21315 W. McNichols Rd., Detroit, Mich.

WIRE BRUSHES

Independent Pneumatic Tool Co., Aurora, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.

WIRE CUTTERS

Redford Iron & Equipment Co., 21315 W. McNichols Rd., Detroit, Mich.

WOODWORKING MACHINERY

Do All Company, Des Plaines, Ill.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Oliver Machinery Co., Grand Rapids 2, Mich.
Parks Woodworking Machine Co., 1546 Knowlton St., Cincinnati 23, Ohio.

X-RAY EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
General Electric X-Ray Corp., 4855 West McGeoch Ave., Milwaukee 14, Wis.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

X-RAY FILMS

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 West McGeoch Ave., Milwaukee 14, Wis.

ZINC

American Smelting & Refining Co., 120 Broadway, New York 5, N.Y.

Classified Advertising

Help Wanted

HELP WANTED

If you carry the qualifications of a foundry executive or supervisor and under 50 years of age, a number of positions are open for your consideration in all types of foundries.

GENERAL MANAGER
SUPERINTENDENT
GENERAL FOREMAN
DEPARTMENTAL FOREMAN

This is not an employment agency. Every reply to this ad will be promptly answered.

BOX 137
THE FOUNDRY CLEVELAND 13, OHIO

SUPERVISOR FOR CUPOLA DEPARTMENT

Must be experienced gray iron melter with knowledge of cupola operations in a gray iron foundry with a melting requirement of 50-60 tons per day. Must be familiar with alloy inoculation and modern cupola practices. Must be cooperative, cost-minded and a good handler of men. Write in detail experience, including places worked, number supervised, tons poured, type of iron melted and personal references. Address: Box 127, The FOUNDRY, Cleveland 13, Ohio.

MAINTENANCE MAN

Malleable iron foundry in Eastern section. Must have mechanical and electrical plant maintenance experience. To work as assistant to plant engineer. Write, giving age, marital status and full information on experience.

BOX 104
The FOUNDRY CLEVELAND 13, OHIO

WANTED

FOUNDRY SUPERINTENDENT—20 ton grey iron foundry. To take full charge of complete foundry operation, moulding, coremaking, cleaning, etc.
MOLDING FOREMAN—To assist foundry superintendent, core room foreman; also machine shop foreman and assembly department foreman.

BOX 105
The FOUNDRY CLEVELAND 13, OHIO

ASSISTANT METALLURGIST

For iron roll foundry located near Pittsburgh, Pa. Prefer man 25 to 30 years old with metallurgical training and chemical laboratory experience. In reply state age, education and experience. Address: Box 101, The FOUNDRY, Cleveland 13, Ohio.

MOLDING FOREMAN

Good opportunity for molding foreman with experience on sandslingers, jolts and squeezers. Must have a successful record in supervising molders. Should be able to organize and instruct employes in efficient operation of the various units to produce quality castings. Must have five or more years of supervisory experience in high production or semi-production gray iron or semi-steel foundry. Write experience in detail, listing size of shop, number of people supervised, type of work performed and references. Pennsylvania position. Address: Box 117, The FOUNDRY, Cleveland 13, Ohio.

COREROOM FOREMAN

With five or more years' experience in a supervisory capacity. Must understand coremaking thoroughly and have the ability to supervise coreroom of 150 employes. Must have ability to organize and instruct the employes in turning out quality work. Shop produces cores for large and small castings of gray-iron and semi-steel. Give complete references, listing size of shop, number of employes supervised and type of work performed in first letter. Pennsylvania position. Address: Box 116, The FOUNDRY, Cleveland 13, Ohio.

Help Wanted

FOUNDRY SUPERINTENDENT

Midwestern grey iron foundry producing heavy diesel engine and machinery castings requires experienced man with all operations, including estimating. State age, education and experience in detail. Address: Box 113, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

For plant now employing about 200 men in Middle West. Age 35 to 40 preferred. Experienced in jobbing production of light and medium weight castings. Capable of rigging for production. Man with both pattern shop and foundry experience preferred. Address: Box 123, The FOUNDRY, Cleveland 13, Ohio.

GENERAL FOUNDRY FOREMAN

Heavy work and pit work, must know rigging. Good opportunity for right man. Plant located in Middle West. State age and past experience. Address: Box 125, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Nonferrous jobbing foundry employing about 60 men and handling all types of alloys, desires an experienced man capable of taking charge of molders and coremakers and supervising foundry operations. State qualifications, experience and salary expected in application. Address: Box 140, The FOUNDRY, Cleveland 13, Ohio.

EXPERIENCED MAN

Capable of taking complete charge of an old established brass ingot and nonferrous smelting plant located in Chicago. Assured future and excellent opportunity for right man. Please state background and qualifications in application. Our men know of this ad. Address: Box 974, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY INSTRUCTOR

In an engineering college. Must have had two years of college work with metallurgical courses and some trade experience in foundry work. College graduate preferred. Address: Box 972, The FOUNDRY, Cleveland 13, Ohio.

MELTERS

Electric furnace steel melters required for basic electric ingot and casting heats. Six ton and fifteen ton furnaces. Address: ADIRONDACK FOUNDRIES AND STEEL, INC., WATERVLIET, N. Y.

DESIGN ENGINEERS WANTED

Two design engineers experienced and qualified in the design of modern hydraulic presses, valves and circuits. Address: Box 115, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY ENGINEER WANTED

Qualified and experienced in modern foundry practice, sand mixing, conveying and foundry material handling. Address: Box 114, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY ENGINEER OR FOUNDRY MANAGER

Qualified in modernization, foundry practice, methods and procedure. Must be college graduate and willing to travel. Four to five years' experience. Age 30 to 45 years. Address: Box 102, The FOUNDRY, Cleveland 13, Ohio.

METALLURGIST—FOUNDRYMAN

Young man with technical and metallurgical background needed for work in our modern new gray iron foundry located in suburb of Chicago. Work involves control operations in connection with cupola and electric furnace melting along with other foundry controls. Prefer man familiar with photo-micrographical work. Excellent opportunity for a permanent connection in a growing aggressive organization. State fully your qualifications.

BOX 141
THE FOUNDRY CLEVELAND 13, OHIO

Positions Wanted

PATTERNMAKER

Thorough experience in wood and metal patternmaking. Interested in position as foreman in large shop or working foreman in small shop. Can estimate costs from blue prints, do layout work for pattern shop and also arrange for gates, risers and best method to mold in foundry. Experience on layout table and check work, small or large. Able to take over shop and run to show profit. Address: Box 134, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY MANAGER OR SUPERINTENDENT

Thoroughly experienced in ferrous and nonferrous and in all phases of foundry operation. Light to heavy work. Green and dry sand. Practical on molding and coremaking. Thoroughly experienced in cupola control. Well versed in grey iron metallurgy and foundry costs. Thoroughly experienced in production and executive capacities. Sales, contact and expediting experience. Neat appearing and pleasing personality. Employed as superintendent. Address: Box 887, The FOUNDRY, Cleveland 13, Ohio.

GENERAL MANAGER

With long, valuable experience in managing, building up and maintaining foundry and machinery business on profitable basis, invites correspondence preliminary to interview. Ability to direct all office, sales, financial and production activities efficiently and economically unquestionably established by previous record. Address: Box 946, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Metallurgical and chemical training in England. Twenty-five years' experience in the United States as metallurgist, superintendent and manager in leading steel foundries. Three years as instructor in engineering school. Member principal technical associations in metals field. Age 48, married, two children. Address: Box 136, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOREMAN OR SUPERINTENDENT

Wants charge of gray iron jobbing shop. Practical experience on green dry sand light and heavy castings. Cupola practice. Sixteen years as foundry foreman. Address: Box 126, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Capable, experienced in steel and grey iron, presently employed desires to make a change. Have quite a number of years' experience in office management, accounting, inventory controls, costs, system installations, foundry analysis and also personnel. Desire to make contact with an organization who wishes an ambitious, capable and sincere man. Address: Box 106, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY ENGINEER

Registered mechanical engineer, age 28 with production supervisory experience and training in electrical engineering. Plant engineering and technical experience in large light metal foundry. Desire position as foundry engineer or supervisor for technical and engineering functions in medium size foundry. Address: Box 110, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRYMAN

Thirty years' experience in nonferrous foundries as moulder, foreman, superintendent, general manager and part owner wishes to take complete charge of small medium size brass and aluminum foundry on small salary and profit sharing basis or will take straight salary. Can handle everything from furnace room to costs. Good at handling men. Prefer shop in small or medium size town any place. Address: Box 916, The FOUNDRY, Cleveland 13, Ohio.

CHIEF CHEMIST

16 years' experience in ferrous and nonferrous rapid metal analysis—furnace control. Chicago area. Address: Box 109, The FOUNDRY, Cleveland 13, Ohio.

Classified Advertising

Positions Wanted

FOREMAN
METAL PATTERN MAKER

Successful background in supervising and planning diverse pattern equipment, valves, fittings, plumbing goods, matchplates, and coreblowing equipment for highest production and low scrap. Will go anywhere. Address: Box 132, The FOUNDRY, Cleveland 13, Ohio.

CORE ROOM SUPERINTENDENT

Twenty-five years' experience in all kinds of core making. Rigging for any kind of core room machinery and sand mixing for all types of cores. Address: Box 986, The FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT—MANAGER

38 years of age, 18 years' practical gray iron experience. Ten years as general foreman and foundry superintendent. Good references. Address: Box 138, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERVISOR

Desires connection with jobbing and production foundry. 30 years as molder and foreman. Now superintendent in foundry pouring 35 to 40 ton per day. Address: Box 912, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Twenty-eight years' experience as foundry superintendent. Practical molder. Understand cupola thoroughly. Prefer position with foundry making high grade castings. At present employed. Address: Box 122, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Mechanical engineering graduate with 20 years' experience as plant manager and superintendent of plants producing high quality grey iron production and jobbing castings and production machining. Thoroughly familiar with all modern foundry equipment and methods. Successful in handling office and plant organization, labor and public. Address: Box 119, The FOUNDRY, Cleveland 13, Ohio.

ENGINEER

B.M.E., M. Met. E.—27—married—2 years' teaching in machine tools, shop work, metal processes, foundry and welding. One year experience in aviation and camera industries. Interested in production, sales engineering, advertising and technical writing. Address: Box 133, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Capable, progressive grey iron foundryman now employed desires to make a change. Have 23 years of experience covering all phases of the business. Understand foundry costs thoroughly and can apply this knowledge to very good advantage. Desires to make a contact with an organization who wishes to secure ambitious, capable and honest man. Age 44 years. Address: Box 876, The FOUNDRY, Cleveland 13, Ohio.

EXECUTIVE

Desires connection with progressive company. Age 45. Experienced as chief metallurgist, automotive plant, also production manager and at present works manager of alloy foundry. Experienced also in sales and service. Excellent references as to character and ability. Address: Box 112, The FOUNDRY, Cleveland 13, Ohio.

ALUMINUM PERMANENT MOLD FOUNDRY ENGINEER

TWENTY-FIVE YEARS' EXPERIENCE. COOKING UTENSIL SPECIALIST OR ANYTHING YOU WANT MADE. FULL OR PART TIME. ADDRESS: BOX 667, THE FOUNDRY, CLEVELAND 13, OHIO.

CLEANING ROOM FOREMAN

Young man desires position with progressive foundry. East or Midwest preferred. Thoroughly experienced in handling small and medium sized carbon and alloy electric steel castings. Address: Box 997, the FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

PLANT MANAGER

Foundry, machine and fabricating. Excellent record in operations, production planning, engineering sales, industrial relations and purchasing. Will stand critical inspection. Address: Box 960, The FOUNDRY, Cleveland 13, Ohio.

Manufacture's Agents

CORE OIL DISTRIBUTORS

Wanted by well known manufacturer for St. Louis and Pittsburgh areas. Write us in care of: Box 107, The FOUNDRY, Cleveland 13, Ohio.

SALES REPRESENTATIVE

Established nonferrous foundry desires Sales Representative for Western Pennsylvania. Will consider salary and expenses or commission basis. Address: Box 129, The FOUNDRY, Cleveland 13, Ohio.

REPRESENTATIVES

Established Metal Abrasive Company wants representatives who sell direct to ferrous and nonferrous foundries and forge shops. Give particulars about your present setup and territory you can cover. Write us at once. Address: Box 124, The FOUNDRY, Cleveland 13, Ohio.

MANUFACTURER'S REPRESENTATIVES

Long established sand and permanent mold aluminum castings foundry wants representation in Northern New York state, New England, Philadelphia and south areas. Specialize in high quality primary heat treated aluminum alloys. Have own pattern mold and heat treating facilities. Write: Address: Box 108, The FOUNDRY, Cleveland 13, Ohio.

Accounts Wanted

FOUNDRY SUPERINTENDENT

With several years' experience in malleable and grey iron foundries desires connection as customer contact man and soliciting new accounts. Malleable foundry preferred. Address: Box 121, The FOUNDRY, Cleveland 13, Ohio.

ACCOUNTS WANTED

Established Detroit manufacturer's representative selling large tonnage die castings to automotive accounts wishes to represent a malleable castings or gray iron foundry. Address: Box 999, The FOUNDRY, Cleveland 13, Ohio.

Foundry Consultant

ATTENTION: GRAY IRON FOUNDRIES

Get lower sulphur and hotter iron with less pig iron or no pay. New method of charging. Write for circulars. Address: HENRY MESSER, 1117 WILLOW AVE., SOUTH SAN FRANCISCO, CALIF.

Opportunities

MANUFACTURERS

Foundry cast-alloy products, novelty one to three-way swivels. Will sell well to industrial and consumer fields. Royalty license basis. Address: FRED ANDERSON, BOX 567, SHERIDAN, OREGON.

MANUFACTURERS' OPPORTUNITY

This company has improved a permanent mold process that now produces aluminum enameled tubs, comparable to porcelain, which at one time produced cast iron tubs. Inquiries invited.

WAGNER PERMANENT MOLD CO.
2910 EMPIRE AVE. BURBANK, CALIF.

Opportunities

90 PER CENT OF THE CUPOLAS MELT UP TO ONLY 50 TO 60 PER CENT

capacity per hour—although the best and hottest iron is produced only when cupola is operated to its capacity. Report on your cupola may prove an eye-opener—usually the savings are surprising. Every pound of steel used in cupola mixtures reduces cost and increases strength 20 to 60%, because steel is purer than the most expensive pig iron. Watch the scrap pile—statistics prove casting losses can be held between 1 to 5% depending on the line of work. Our system is not an expense—but a valuable investment. Synopsis free.

McLAIN'S SYSTEM INC.
236 E. NORTH AVE.
MILWAUKEE, 12, WIS.

OPPORTUNITY

We can furnish at any point slack, fibre and tight barrels; also fibre and steel drums. Address: BUCKEYE COOPERAGE COMPANY, 3807 ORANGE AVENUE, CLEVELAND 15, OHIO.

Employment Service

EMPLOYERS
SERVICE BUREAU
A SUPERIOR PERSONNEL SERVICE FOR DISCRIMINATING EMPLOYERS
ESTABLISHED 1922

Specializing in thorough screening of qualified personnel for any phase of foundry operations.

APPLICANTS

If you can furnish QUALIFIED references attesting to your CAPABILITY and DEPENDABILITY, your application will be accepted and we will secure for you the desired position, without cost. Our service is 100% FREE to applicant.

IMMEDIATE OPENINGS
Partial Listing

SUPERINTENDENTS	To $10,000
ASSISTANT SUP'TS.	To $7,200
GENERAL FOREMEN	To $6,000
CORE ROOM FOREMEN	To $5,200
MELTING FOREMEN	To $5,400
MOLDER FOREMEN	To $5,200
CLEANING ROOM FOREMEN	To $4,800
CUPOLA SUPERVISORS	To $5,200
SR. INDUSTRIAL ENGINEERS	To $7,200
JR. INDUSTRIAL ENGINEERS	To $3,900
TIME STUDY ENGINEERS	To $4,800
MASTER MECHANICS	To $6,600
PLANT ENGINEERS	To $6,000
METALLURGISTS	To $5,200
CHEMICAL ENGINEERS	To $4,800
CHEMISTS	To $4,200
PRODUCTION CONTROL	To $4,800
DESIGN ENGINEERS	To $6,000
SALES ENGINEERS	To $6,000
ACCOUNTANTS	To $6,000

If you are experienced in any phase of foundry operations—and desire to improve your future working conditions:

WRITE
EMPLOYERS SERVICE BUREAU
33 WEST WASHINGTON ST.
CHICAGO 2, ILL.
TELEPHONE: FINANCIAL 1155

SALARIED POSITIONS

$3,500—$35,000

If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (38 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details.

R. W. BIXBY, INC.
101 DUN BLDG. BUFFALO 2, N. Y.

Classified Advertising

Employment Service

SALARIED PERSONNEL

$3,000—$25,000. This reliable service, established 1927, conducts confidential negotiations for high-grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Address: JIRA THAYER JENNINGS, 241 ORANGE STREET, NEW HAVEN 10, CONN.

Open Capacity

GRAY IRON CASTINGS

Open Capacity Available

Inquiries Solicited

TREDEGAR COMPANY

RICHMOND 11, VIRGINIA

OPEN CAPACITY

Jobbing Midwest foundry located in Cleveland, Ohio has open capacity for 100 ton per month—bench, squeeezer and floor work. Address: Box 111, The FOUNDRY, Cleveland 13, Ohio.

AVAILABLE CAPACITY

Our foundry has open capacity to supply small and medium size gray iron castings. Send sample. Address: OREGON CASTINGS CO., RD 3, Lititz, Pa.

OPEN CAPACITY

Bench, squeezer and light floor work. Address: Buckler Foundry Co., Inc., East Alton, Ill.

OPEN CAPACITY

Foundry capable of handling 500 tons grey iron per month in Eastern Massachusetts. Will lease to large user or operate for production of one company as its own foundry principals only. Address: Box 965, The FOUNDRY, Cleveland 13, Ohio.

OPEN CAPACITY

Open capacity in grey iron foundry. Waterfronts—burners—bench, pumper and floor work Address: P.O. Box 321, Belleville, Illinois.

OPEN CAPACITY

Well equipped foundry desires capacity for bronze or aluminum castings, any size or weight, matchplate or bench work. Send inquiries direct to: ATLANTIC NON-FERROUS FOUNDRY, INC., STARR STREET, JOHNSTON, RHODE ISLAND.

Capacity Wanted

CAPACITY WANTED

Grey iron foundry which can make castings for us. Will send blue prints for estimates. Address: WALTER & CARRELL MFG. CO., DENVER, COLO.

Foundries For Sale

FOR SALE

Gray iron foundry, Northeastern Oklahoma. Operated continuously since 1910. Fully equipped, leased rail siding, pattern coke and sand storage. Doing good business. Address: Box 840, The FOUNDRY, Cleveland 13, Ohio.

Foundries For Sale

CALIFORNIA FOUNDRY
IDEAL CLIMATIC CONDITIONS

One of the largest privately owned iron foundries in the State. $40,000 will buy entire set-up. Owner will give long term lease on new buildings and 2 acres land at $400.00 per month. Located in thriving San Joaquin Valley mid way between Los Angeles and San Francisco. Only experienced Foundry men need apply. Contact owner for further particulars.

WRITE, PHONE OR WIRE
WM. E. HOWE
TULARE FOUNDRY TULARE, CALIF.

GREY IRON FOUNDRY

Large, well equipped production squeezer foundry. Have materials and customers. We have it, but lack the ability to operate it. Will sell, trade or sell a portion of, or what have you to suggest? Address: Box 118, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

Good money-making foundry for sale known as the C. H. Cox Foundry. Everything complete. Located on highway #41 and Southern Railroad. No labor trouble. If interested write or call: Mrs. C. H. Cox, Box 52, Sparks, Ga., or phone 2141.

FOUNDRY FOR SALE

Located in El Paso, Texas, brass and iron foundry in operating order. Will sell at replacement costs and will lease or sell land on property site. Will consider selling foundryman with experience part interest in business who can make quality brass and iron. We have the business for the man who has the know how to produce at a profit. For details write:

EDWARD HINES INC.
PO 736
EL PASO, TEXAS

GRAY IRON FOUNDRIES

Medium size foundry well equipped for jobbing work. Good organization. Steady business. Modern foundry producing its own specialty items. Very profitable business. Priced to sell.

EDWARD H. ZOLL
790 BROAD ST. NEWARK, N. J.

FOUNDRY & PATTERN SHOP

Located in Cleveland. Capacity—35,000 lbs. of aluminum castings per month (one shift). Fully equipped with modern equipment. In continuous operation for over 25 years. Includes modern factory type brick building and land. A splendid buy for the right party. Call or write

MARK G. SNOW
773 UNION COMMERCE BLDG.
CLEVELAND, OHIO
PHONE—CHERRY 2342

Wanted-To-Buy

WANTED
PATTERNSHOP

Experienced patternmaker, wood and metal patterns, wants to acquire part interest in pattern shop or buy outright. Small or large shop doing wood and metal work where first class patterns can be obtained. Address: Box 135, The FOUNDRY, Cleveland 13, Ohio.

WANTED TO BUY

25 or more Tote Box Platform Assemblies, box 30" wide x 34" long overall dimension, 21" deep, made of 10 gauge steel, securely welded to platform 30" wide x 34" long x 12" high, in the clear, made of 7 gauge steel. Estimate weight of these boxes, around 300 pounds each. Address: SEMLER COMPANY, JEANNETTE, PENNSYLVANIA.

WANTED

#92 or #91-10 Osborn core blowing machine with 1010 to 1570 cubic inch capacity sand reservoir. Address: Box 128, The FOUNDRY, Cleveland 13, Ohio.

Wanted-To-Buy

WANTED

Two air jolt hand strip molding machines, 13" x 18" flask size. Wire, write or telephone: T & W MFG. CO., 1529 CRYSTAL AVE., KANSAS CITY, MO.—PHONE BENTON 0987.

WANTED

Patterns and core boxes for 125# and 150# standard pipe fittings. Need sizes 3" to 8" in Ells and Tees. Shrinkage allowance ¼" per ft. Please submit sketch detailing wall thickness and other dimensions. Address: Box 100, The FOUNDRY, Cleveland 13, Ohio.

MIXERS WANTED

Used Simpson Intensive Sand Mixers. State size, condition and lowest cash price for immediate acceptance. Address Box 578, The FOUNDRY, Cleveland 13, Ohio.

For Sale

TURBO BLOWERS

2100 cfm @ 10 oz. Spencer, with 10 HP, 220/440 V. 3/60/3600 RPM motor.
(4) 675 cfm @ 6 oz., Spencer, driven by 2 HP, 220/440 V., 3 ph. 60 cycle 3600 RPM.

PRESSURE BLOWERS

1600 cfm @ 2 lb. General Electric with 20 HP, 3/60, 3600 RPM motor.
1400 cfm @ 8 oz. Robinson with 5 HP, 3/60, 3600 RPM motor.
1100 cfm @ 16 oz. Sturtevant
800 cfm @ 24 oz. American with 10 HP, 3/60, 3600 RPM motor
500 cfm @ 14 oz. McKee, with 5 HP, 3/60, 3600 RPM motor.

HOISTS

¼ Ton—Detroit Titan—440/3/60
¼ Ton—Budget—220/3/60
¼ Ton—Comet—440/3/60
¼ Ton—Shepard—220 D.C.
½ Ton—Chisholm Moore—440/3/60
½ Ton—Cleveland—440/3/60

THE MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVENUE
CLEVELAND 14, OHIO

FOR SALE

WHITING #9 CUPOLA. IN EXCELLENT CONDITION. IMMEDIATE DELIVERY. FULL DETAILS ON REQUEST. WRITE, WIRE, OR PHONE.

NATIONAL INDUSTRIAL CORP.
38 S. DEARBORN ST., CHICAGO, ILL.
PHONE: RANDOLPH 4262

FOR SALE

American Wheelabrator—48" x 72" complete.
Also other Foundry Equipment
We invite your inquiries

BALCHER MACHINERY SALES
1819 E. 33rd ST. CLEVELAND 14, OHIO

ELECTRIC FURNACE

Northwest Firm can ship on 5 day's notice a used ⅜-1 ton Green Electric Furnace. Furnace is complete with 600 KVA 12 K.V. primary furnace transformer with 3 secondary voltage taps arranged for manual switching, automatic electrode control with motor generator set. Also includes primary disconnect and circuit breaker. Reason for sale, steel foundry discontinued.

BOX 131
THE FOUNDRY CLEVELAND 13, OHIO

FOR SALE

Portable Conveyors

1—American 13 ft. x 8" belt.....$200.00
1—Coaltoter 20 ft. x 10" belt.....$250.00
Less than 1 year old

WARD BROS. FOUNDRY INC.
HORSEHEADS, N. Y.

Classified Advertising

For Sale

FOR SALE

OVERHEAD ELECTRIC TRAVELING CRANES

Tons	Make	Span	Current
5	Northern	21'0"	230-VDC.
5	Northern	25'0"	230-VDC.
5	Milwaukee	50'0"	230-VDC.
10	Northern	37'10"	230-VDC.
5	Milwaukee	60'0"	220-VAC.
25	Alliance	55'0"	230-VDC.

ELECTRIC MONORAIL HOISTS

QU.	TONS	MAKE	CURRENT
7	½	Lo-Hed & Shepard	230-VDC.
1	1	Shaw-Box	220-VAC.
1	2	Shepard	230-VDC.
1**	2	Shepard	220-VAC.
1*	2	Shepard	230-VDC.
3*	3	Lo-Hed	230-VDC.
1*	5	Lo-Hed	220-VAC.

*—2-Motor, Fl. Op. **—2-Motor, Cg. Op.

ALL ABOVE IN STOCK OFFERED REBUILT & GUARANTEED

SEND FOR OUR STOCK LIST OF A.C. & D.C. GENERAL PURPOSE CRANE & MILL MOTORS, ELECTRIC BRAKE & CONTROL EQUIPMENT, MOTOR GENERATOR SETS, TRANSFORMERS, ETC., OF ALL SIZES.

T. B. MACCABE COMPANY
4300 CLARISSA ST.
PHILADELPHIA (40), PENNA.

FOR SALE

1—Royer Type NC2-46—iron wheels

2—Model S—B. & P. Screenarators—rubber wheels

2—Combs Type V riddles

2—Osborne jolt squeezers, Type 275-J

Send us your inquiries on any foundry equipment.

RAY P. SCULLY
SCULLY MACHINERY & EQUIPMENT CO. NOT INC.
767 MILWAUKEE AVE.
CHICAGO 22, ILL. PHONE: CANAL 0314

FOR SALE

1 Swing Grinder—Good Condition—National Brake & Electric Company—10' Long—24" x 3" Grinding Wheel—3 Wire A.C. Motor.

New tapered Flasks—Wood & Aluminum—Sizes 10 x 18 to 15 x 15—4" Cope—3" Drag. Diamond - Peerless - Obermayer - Adams - McCaffery-Hines.

1 Front End Loader—Will fit any large Tractor on Wheels—George O. Roper—No. 1328—Type 2—Spec. No. 1567.

Buckeye Flask Hardware—50 Prs. Ears—40 Prs. 6" Pins—130 Prs. Plate Slides.

Steel Bands Various Sizes.

ALBANY CASTINGS CO., INC.
VOORHEESVILLE, N. Y.

FOR SALE

1—#559 Osborn jolt stripper moulding machine.

1—#444 Osborn jolt rockover pattern draw moulding machine.

Both machines new, have never been used.

SCHILL MANUFACTURING COMPANY
CRESTLINE, OHIO

For Sale

FOR SALE

Rebuilt Hough model HS ½ cubic yard payloader. Excellent for unloading sand from box car or for general foundry work.

TYLER EQUIPMENT CORPORATION
TELEPHONE 375
251 SHAKER ROAD
EAST LONGMEADOW, MASS.

FOR SALE

Sand cutting equipment

1—Molders Friend sand cutter—50 inch wide cut—used one year.....$990.00

1—Royer sand conditioner model No. NC 2-11 good condition $300.00

OAKLAND FOUNDRY CO.
BELLEVILLE, ILL.

FOR SALE

120 steel flasks 10" x 32" consisting of
120 copes 7½" high
120 drags 3" high
120 jumps 3" high

GALE MANUFACTURING COMPANY
P.O. BOX 30
ALBION, MICHIGAN

FOR SALE

1 type Q Electromelt arc melting furnace 1½ ton per hour rating, complete with transformer 1200 KVA and all operating controls.

BOX 120

The FOUNDRY CLEVELAND 13, OHIO

FOR SALE

1—#2 Climax wire straightener complete with bench and motor. Costs $875.00 new. Used very little. Price $350.00. Address: ILLINOIS FOUNDRY CO., SPRINGFIELD, ILL.

FOR SALE

4—Rollover & Jolting Machines, (Osborn) Air. Model 2047-1, Flask Space, 22½ x 21½—10" Draw—
1—Model SS Sand Shakeout, Schneible Co., 5' x 3' x 10", Serial #43466
1—Jeffrey Sanditioner, Serial #4764-0, 133523, with Allis Chalmers 2 HP Motor, 220-440 volts, 3 phase, 60 cycles
1—American Sand Cutter, Type CP, Size 72", Serial #115-R, Distance between wheels 96", Cutting Blades 72", Overall Length 102", 220 volts, 3 phase 60 cycles.
163—Dixon #150 Crucibles, with 4" Lip
All types of Bucket, Belt, Apron, Chain and Booster Conveyor in Stock at all times
Also, Roller Conveyors, 10"-12"-14"-16"-18" and 24" wide in standard 8' and 10' lengths. With and without stands. Rollers above or below frame as desired. Rollers above or below frame.
5—Round End Exhaust Tumbling Barrels with 1" Plates
11—I.R. Blowers, Single Stage Centrifugal, Type FS-345, 3600 CFM with GE Motor, 25 HP, 50-60 cycles, 3/220-440 volts
600 Electric Motors in stock, all sizes, types and horsepowers.
Send us your inquiries, we will be more than pleased to submit additional information to you.

UNIVERSAL MACHINERY & EQUIPMENT CO.
320 EAST BROAD ST.
SHILLINGTON, READING, PA.

For Sale

FOR SALE

No. 372 Besly 53" vertical spindle disc grinders, including radial arm truing device and V-sheave on spindle, but less motor, belts and controls. Equipped for dry grinding but can be changed for wet. Net weight—6820 lbs. $1250

No. 208 Besly 23" and 30" single spindle disc grinders with wheel guards and geared lever feed tables. Furnished with or without new motor drive. Net weight—3240 lbs. 23".. $600

30" $700

Grinding Wheels for use on the above machines, Norton, Besly and Gardner, size No. 16 grain for cast iron and refractory grinding in stock. Have substantial saving to offer on wheels we have in stock.

All grinders guaranteed in first class condition, having seen very little use. We will ship on open account, subject to inspection at destination, to firms of approved credit. All prices are net, f.o.b. Shreveport, Louisiana.

FREDERIC & BAKER
826 ARDIS BLDG. SHREVEPORT 91, LA.

FOR SALE

Well equipped foundry specializing in small and medium size castings for the manufacturing trade, doing a business of $600,000 a year with excellent accounts and operating on a highly profitable basis.

INQUIRIES INVITED

JOSEPH HAINES, JR., & SONS
JENKINTOWN, PENNSYLVANIA

BROKERS IN THE SALE OF INDUSTRIAL PLANTS

FOR SALE

Blaw-Knox Tilting Bronze Furnace.
J. & J. #918-B Rollover, automatic conveyer. Table 44 x 54. 2 Sets of roller channels, 20 inch draw, Capacity 2000 lbs. (Used 2 months).
3 R-9X Rapid Jolt Squeezers (1 new).
1 International Squeezer machine.
We are liquidating our foundry. No reasonable offers refused.

NOLAN FOUNDRY COMPANY
PROSPECT, NEW YORK

FOR SALE

Two used R. C. Mahon Hydrofoam dust collecting systems, capacity approximately 10,000 CFM to 6" static pressure, complete including 40 HP 220/440 3 phase 60 cycle totally enclosed Howell electric motor, 1700 RPM.

One HP 1140 RPM, 3 phase 60 cycle Howell electric motor.

One Clarage exhaust fan type 1E, class 4, size 23.

One Clarage exhaust fan type 1E, class 3, size 23.

Units are complete with Aero-Fin heat make-up heating coils, Allen-Bradley automatic resistance starters. Selling price $950.00 each.

JOHN BEAN MFG. CO.
LANSING 4, MICH.

Classified Advertising

For Sale

FOR SALE

Swing Frame Portable Grinder "Marschke" 3 speed, 16" x 3" complete with new wheel. 7½ HP 220V 3P 60 C.A.C. motor with V belt drive and full belt guards. Not used 60 days.

STEDMAN'S FOUNDRY & MACHINE WORKS, INC.
AURORA, INDIANA

FOR SALE
ALUMINUM CORE PLATES

18—23¼ x 41 x ½" thick
34—12 x 35¼ x ¼" thick
29—12 x 36½ x ½" thick
6—24 x 46 x ½" thick
These core plates have been machined

ROCK ISLAND METAL FOUNDRY, INC.
ROCK ISLAND, ILL.

FOR SALE
TURBO COMPRESSOR
CUPOLA BLOWER

Used one year, 1# pressure, #3 discharge with one 16" blast gate motor, 30 H.P., 1750 R.P.M., 220-440 V, 3 phase, 60 cycle for $1400.00. Immediate delivery.

PRODUCTION PATTERN & FOUNDRY CO.
BOX 299 CHICOPEE, MASSACHUSETTS

FOR SALE

1—Whiting cylindrical ladle, 1350 lbs. capacity, with lining, ladle used but once.

1—500 lb. capacity, cylindrical ladle with lining, roller bearing trunnions, #1 type shank, detachable bail with crane hook eye, ladle used but once.

FAIRMOUNT FOUNDRY INC.
HAMBURG, PA.

FOR SALE

Schutte & Koerting tumbling and washing barrel	$395.00
Globe tumbling barrel, 3 HP motor 220/440/60/3, push button control	175.00
Nichols portable jolt strip molding machine, 26" x 27" table	275.00
International portable jolt strip molding machine, 16" x 30" table	150.00
Tabor stationary jolt squeeze molding machine, 16" x 16" table	150.00
Roller conveyor, ball bearing, almost new, random lengths, 8 to 10 ft. Per ft.	3.50
Buffalo MX blower, flat belt drive, not motorized	55.00
International portable jolt strip molding machine, 20" x 22" table	250.00
Osborn jolt squeeze molding machine, 14" x 18" table	165.00
Milwaukee portable jolt squeeze molding machine, 17" x 21" table	140.00
Ohio electric ventilating fans, type D-72225, DC ½ HP motor	35.00
Walter Kidde fire extinguishers, carbon dioxide cylinders, wall system type	17.50

BILLARD MACHINE & TOOL CO.
PHONE 44 MANSFIELD, PA.

FOR SALE

Wheelabrator—No. 1 tablast. July like new. Complete.....$1750.00. Address: WM. R. SHIELDS CO., General Motors Bldg., Detroit 2, Mich.

FOR SALE

1—Jeffrey SF portable sanditioner, type P with 2 HP motor, 3 phase, 60 cycle 220 volt. Address: Box 983, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

Two foundry shakeouts, 3 x 5-foot Simplicity with TEFC motors (G.E.); good condition, slightly used; priced to sell. Address: P.O. Box 55, East Detroit, Mich.

FOR SALE

2—LADLES, 3 ton steel capacity, standard open straight sided geared, with square bail frame, bowl 43½" diameter by 43½" high, on original skids, manufactured by Modern Equipment Co., $525.00 each, f.o.b. Philadelphia, Pa. Address: STECHER STEEL CO., PHILADELPHIA 32, PA.

For Sale

FOR SALE

1—Clearfield Muller
1—Royer Sand Separator
1—Lancaster Sand Mixer
2—Osborn No. 42 core Rollovers
2—Tabor Rollovers
1—Osborn No. 321 Jolt Squeezer Rollover
1—Davenport Rollover, No. 24-SA
1—Osborn Rollover Core Machine
7—Milwaukee No. 1439 Jolt Squeezer Air Operated

(All Machines Purchased New in 1944)

D. E. DONY MACHINERY CO.
47 LAURELTON RD.

ROCHESTER 9, NEW YORK

LATE MODEL EQUIPMENT

PRICED TO SELL

International type Y.O.L. Moulding Machine (4)
International Type R.E.P. Power Air Clamp Rollover Machine (5)
Upender Unit
International Air Jarring Machine (8)

HARVEY GOLDMAN & COMPANY
9656 FRENCH ROAD

WALNUT 1-1151

DETROIT, MICHIGAN

FOR SALE

Schramm Compressor 10 HP motor with starter, 3 phase, 60 cycle, 40 cu. ft. air per minute—$400.00.
Schramm portable compressor, gas driven motor—$75.00.
Westinghouse induction motor, 10 HP, 220 V., 60 cycle, 3 phase, 32.2 amp. per terminal, 1125 RPM, Style #134256, Serial #1194375, Type CCL—$100.00.

W. N. RUSSELL & CO.
34 ALBERTSON AVE.
WESTMONT, N. J.

FOR SALE

33 inch cupola, complete with brick. Blower—B. F. Sturtevant. 3-500 lb. ladles, shanks, A-1 condition. Just set up and operate. Cash needed urgently. This equipment located 90 miles from Pittsburgh. Address: JOSEPH SHERBACK, 291 WATERVIEW AVE., Bridgeport, Conn.

FOR SALE

1 only—symbol FX355 Ingersoll-Rand cupola blower, serial No. 3-355-G10-rated 4600 CFM, 1-0 MPR, 30 HP, 40 degree, 3500 RPM-200 V, 3 phase, 60 cycle, standard open motor, auto constant air weight control mechanism, including current transformers and starting compensators. Subject to prior sale. Price—$1500.00 f.o.b. Fairfield, Iowa. Address: THE DEXTER CO., FAIRFIELD, IOWA.

For Sale

FOR SALE

Tablast American Wheelabrator No. 2, serial No. A-45900 complete with all equipment except dust collector. Purchased by us in 1943. Can be seen in operation at our plant. Priced attractively for quick disposal.

HILLS-McCANNA CO.
3025 N. WESTERN AVE.
CHICAGO 18, ILL.
PHONE—GRACELAND 1150

FOR SALE

CORE RODS

51000#—5/32" Rd. M.S.—14"
54000#—5/16" Rd. M.S.—14"

IRON & STEEL PRODUCTS, INC.
43 YEARS' EXPERIENCE

13444 S. BRAINARD AVE., CHICAGO 33, ILL.
"ANYTHING containing IRON or STEEL"

PANGBORN FOUNDRY EQUIPMENT

Pangborn Air Blast Machine AU-11.....$100
Pangborn Suction Type Blast Cabinet ES-159—6½ ft. x 3 ft. x 12 ft high.....$200
Pangborn Blast Cleaning Machine AA-1 31" diameter x 48" long.....$90

WOLF EQUIPMENT & SALES CO.
3715 HILDANA RD.
CLEVELAND 20, OHIO

FOR SALE

Hardinge conical ball mill complete with motors, bucket elevator, screw conveyor, switches and magnetic chuck. Never used.

DARIN & ARMSTRONG, INC.
2041 FENKELL AVE. DETROIT 3, MICH.
UNIVERSITY 2-3413 J. B. BENJAMIN

FOR SALE

1—Dispatch core oven size 7'6"x9'6" complete with oil burner and electrical controls.
5—Core racks to fit oven.
5—Rapid portable jolt squeeze molding machines.
1—New Whiting skip charger Std. 5-V hoist unit.
1—New Spencer blower #1220 with 20 horsepower motor.
1—Set Foxboro equipment for blower.
1—Royer sand separator model NDP 2 horsepower motor.
1—Std. 23" EZ pour crane ladle V-Bail 1000 lb. capacity.
1—Stock core cutter and shaper.
1—#3 Whiting cupola complete with blower.
1—New Fairbanks platform scale 1000 lb. capacity.
1—Std. spark arrester.
1—#3 ring sill.
1—Standard door frame for #3 cupola with 8.75' bucket.
15—Snap flasks—various sizes.

EAGLE MFG. CO.
APPLETON, WIS.

HARD IRON STARS

FOR SALE

IMMEDIATE DELIVERY

Prices on request

CROWN FOUNDRY CORP.

PHELPS, N. Y.

FOR SALE

One 12" L.J.S. International post jolt squeezer molding machine. Excellent condition. Attractive price. Address: CALUMET STEEL CASTINGS CORP., HAMMOND, INDIANA.

FOR SALE

New heavy duty motorized rod cutter, 65 cuts per minute; capacity: ¾ inch round hot rolled steel. Brand new. $890.00 f.o.b. Cleveland. Address: The Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.

Classified Advertising

For Sale

FOUNDRY EQUIPMENT FOR SALE

Several 5" Adams Wood Slip Flasks—various sizes.
90—Grey Iron Jackets—various sizes.
6—30" x 60"—Late Model Tumbling Mills—motorized. All of the above nearly new.
1—48" square x 84" long Tumbling Mill—belt driven.
2—No. 10 SE-2 Milwaukee jolt squeeze molding machines.
1—8" Milwaukee squeezer.
1—Robbins Flotex shakeout unit 4' x 5'—heavy duty.
6—Robbins, model 30-40 Flotex shakeout unit, 2,000 lb capacity.

DETAILED LIST ON REQUEST
OLIVER CORPORATION, PLANT #1
533 SOUTH CHAPIN STREET
SOUTH BEND 21, INDIANA

FOR SALE

1—#1 Simpson intensive mixer with 5 HP motor.
1—Riehle tensile testing machine, 200,000#.
1—Tinius Olsen 50,000# tensile testing machine with 1 HP motor.
Vibrating screens, single and multiple deck, Tyler Hummer, Allis Chalmers, up to 5' x 10' screen surfaces.
1—Day Roball screens, model S2, 40" x 10' two deck, m.d.
2—Coombs Gyratory Riddles, m.d.

CONSOLIDATED PRODUCTS CO., INC.
13-20 PARK ROW NEW YORK 7, N. Y.

FOR SALE
BLAST CLEANING CABINET

1—Model #63, type EN, Pangborn blast cleaning cabinet, including dust collector and exhauster. Ser. #2072906. Good condition, reasonably priced.

PETRUS INDUSTRIAL MACHINERY SALES
1486 W. 25th ST. CLEVELAND 13, OHIO
PHONE MAIN 1203

FOR SALE

Complete pattern shop equipment and supplies: pattern mill, saws, lathes, joiner, grinders, sanders, all Oliver equipment, drill presses, etc. Nonferrous foundry equipment and supplies, hand tilt furnaces, crucibles, squeezers, etc. Call or write:

CARVER PUMP COMPANY
MUSCATINE, IOWA
PHONE 3100

FOR SALE

Pangborn #53 type ENZ sand blast cabinet complete. Never used . . . . $750.00—serial #2CD1-4398. Also—400# aluminum crucible furnace complete . . . . $600.00.

SPENCER HEATER DIVISION
THE AVCO MFG. CORP.
164 PARK ST.
WILLIAMSPORT 19, PA.

For Sale

SAND BLAST MACHINES

We have in stock three brand new complete portable sand blasting machines 100 pound, 350 pound and 650 pound capacity in sand. Can be used with steel grit also. New "Sanstorm" type, non-clogging design. Ideal for auto body shops, foundries, heat treaters, painters and forge shops. We also have in stock for immediate shipment a #22 Moline portable molding machine (brand new) also a used belt drive tilting tumbling barrel.

FEDERAL FOUNDRY SUPPLY COMPANY
4600 EAST 71st ST. CLEVELAND 5, OHIO

FOR SALE—FOUNDRY EQUIPMENT

Two gas-fired circular type annealing furnaces, 48" x 48" and 36" x 30", complete with premix burners, furnace piping and motors.
One 10" x 55" stroke and one 8" x 42" stroke air hoists for use with above furnaces.
One #421 Ell Millett core oven, four 5" x 30" and one 10" x 30" drawers, swinging from side hinges.
One Type 520 bull sulky ladle, 250# capacity, new.
Three 18" x 18" table Osborne plain jolt machines.
Other miscellaneous used motors and foundry equipment at right prices. Write us for circular and prices.

KELLY FOUNDRY & MACHINE CO.
ELKINS, WEST VIRGINIA

FOR SALE
MOLDING MACHINERY

1—Johnson & Jennings Model 918 Stationary Rollover Jolt Machine. Pattern table 44" x 54" Pattern Draw 20" Cap.
12—Osborne Model 2047-1 Stationary Rollover Jolt machines. Flask space 22½" x 21½" Draw 11½".
These machines are like new, and PRICED TO SELL.

CANTON INDUSTRIAL SALVAGE CO.
325 ELEVENTH ST. S.E. CANTON, OHIO

FOR SALE
SAND CUTTER

1—50" Moulders Friend sand cutter. Good condition. 3 phase, 60 cycle, 220/440 volts. Address: Box 103, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

1—(NB-2) Royer sand separator and blender in first class condition, price. . . .$250.00. Address: A. LANGLOIS & SONS, INC., P.O. BOX 107, RUTLAND, VERMONT.

FOR SALE

One (1) Pangborn rotoblast type GK-2 #14 complete with all motors. Has no controls nor loading bucket. Address: Box 130, The FOUNDRY, Cleveland 13, Ohio.

EQUIPMENT FOR SALE

MOLDING MACHINES

4—#815-B Johnston & Jennings jolt-rollover-draw 30" x 40" table, 15" draw.
3—75J Osborn Jolt Squeeze
2—SPO #611-B Stationary Oscillating Squeeze Strippers
1—SPO #4½ JHS Air Jolt Hand Strip
1—Tabor Plain Squeeze, Strain Rod Type
3—Mumford 3" Cyl. Core Jolt, with 20" x 15" Table

BLOWERS FOR CUPOLAS AND FURNACES

1—16 x 24 HD Connersville 2500 CFM at 5 lbs.
6—#805 General Blowers, 5 HP, 3/60/220, 1400 CFM at 8-oz. pressure
Maxon-Premix Blowers for Gas, ⅛ to 1 H.P.

METAL MELTING EQUIPMENT

1—Recirculating Gas Fired Oven with all controls, suitable for Core Oven
2—Hausfeld 1000# Aluminum Capacity Furnaces, Barrel Type, Open Flame, Oil Fired
2—Hausfeld 2000# Aluminum Capacity Furnaces, Barrel Type, Open Flame, Oil Fired
1—Aluminum Electric Heat Treating Unit, 75 KW, 220 Volt, Batch Type, with Basket and Quench Tank
3—Stationary Gas Fired #60 Crucible Furnaces, with ¼ H.P. Maxon-Premix Blowers
2—Monarch-Rockwell Rotating, 500# Brass. Oil
New 32" to 41" Dia. Shell Cupolas made to order

TUMBLING MILLS AND SAND BLAST

1—Pangborn #2 Barrel, Suction Feed, Motor Drive, Complete
1—American Foundry Equipment Co. Stationary Cabinet Type Wheelabrator, complete with Elevator and all Motors
1—American Foundry Equipment Co. Wheelabrator, 45" Dia. Table, Complete with Motors
2—Pangborn No. 2 GH direct pressure type sandblast barrels, motor driven. Complete units.
1—Pangborn LE 6 ft. sandblast table, continuous sand feed, motor driven. Complete unit.
1—Pangborn LE 4 ft. sandblast table, continuous sand feed, motor driven. Complete unit.
3—Pangborn type AV direct pressure sandblast generators. Sand capacity 650#.
1—Pangborn Sand Blast Unit including generating tank, shot cleaner, bucket elevator and dust collector with motor. Suitable for use with room.

1—Mono-Rail System Complete with approximately 1200 ft. of track, 74—250# capacity 110 Volt hoists, two and four wheel trolleys, switches, 35—2000# 20 ft. bridges, and all necessary parts to install.

MISCELLANEOUS

1—American sand cutter model "AM", size 74-50; 3/60/220 electric motors.
4—Heavy duty flexible shaft grinders
1—Model "M" Beardsley-Piper Screenerator, 3 H.P., 220 Volt, 3 Phase, on Rubber Tires
30—Jib Cranes, Floor Type, 1000 to 4000 lbs. capacity, 180° swing, 10 to 15 ft. arms
30—1000 lbs. Capacity Budget Electric Hoists
5—Sturtevant Dry Type Dust Collector Exhausters, 12500 CFM with 25 H.P. Motors
5—Low Lift Electric Trucks, 2000 lbs. capacity and up. Riding Operator Style
1—Heavy Duty Back Geared Sprue Cutter, 1⅛" square knives, T & L Pulley Drive
6—Worm Geared Tilting Ingot Mold Stands, 6' to 12' Long
1—Sly 10' x 28' x 7' Sand Blast Room complete with mechanical shot handling and four 5-Ton cars.
Miscellaneous Electrical and Gravity Conveyor Systems

CLIFTON MACHINERY CO.
1023 W. 6th ST. CINCINNATI 3, OHIO
PHONE PARKWAY 7812

FOR SALE

1—40 x 58 Herman jarr molding machine, complete serial 2552. Address: Box 963, The FOUNDRY, Cleveland 13, Ohio.

CLASSIFIED ADVERTISING RATES

POSITION WANTED—Minimum advertisement set solid, 30 words, $2.00. Additional words 7c each.

ALL OTHERS—"Help Wanted"—"For Sale"—"Wanted"—"Personals"—"Services", etc., minimum advertisement set solid, 30 words or less, $4.00. Additional words 12c each.

NOTE—If replies are to be sent to a box number in care of THE FOUNDRY, add 6 words to your advertisement for box number and address.

Any advertisement set in all capital letters, add 50% to the above rates.

* * *

Classified advertising forms close 13th of month preceding issue.

One of a series *of messages to help you increase your understanding of business paper advertising, and its effect on your business.*

How much longer can your company afford to "refuse business tactfully"?

LET'S FACE IT — the honeymoon is about over. It was fun while it lasted, but it won't pay the rent. Not now.

After an absence of seven years, the spectre of a buyers' market is once more rearing its head, and its expression plainly reads—"I'm going to be hard to get."

This doesn't scare anybody who hasn't forgotten *how to sell.* But there are quite a few of us in American business who could use a quick refresher course. (We've had a long "vacation.")

When it comes to production, our output is up almost 100 per cent. We've acquired a lot of new techniques on the assembly line, because it was obvious that if there were to be any profits left—after increased labor costs, high-priced materials, and taxes—we'd have to trim every last ounce of fat off the manufacturing cost per unit.

But now the time has come when we must apply the same philosophy to the *manufacture of a sale.* That means—*more mechanization!*

Confronted with a buyers' market, how much will it cost *your* company to produce one unit of sale? A prohibitive sum, if you're going to depend entirely on personal contact. You'd have to hire a tremendous force of salesmen to cover the field. Even then, much of their valuable time would be spent on "missionary work"—which is really a job for *mechanized selling.*

Mechanized selling is simply another name for consistent and aggressive advertising. Like the machine on the production line, it is a multiplier of men's efforts, for it enables them to produce (*and earn*) far more than they could alone.

And when it goes to work in the business press, it becomes the most efficient machine at your disposal for *manufacturing sales at a profit!*

Just how efficiently does business paper advertising work? If you'd like to see some examples, we'll be glad to send you a recent ABP folder on actual results. Also, if you'd like reprints of this advertisement (or the entire series) to show to others in your organization, you may have them for the asking.

THE FOUNDRY

is one of the 129 members of The Associated Business Papers, whose chief purpose is to maintain the highest standards of editorial helpfulness—for the benefit of reader and advertiser alike.

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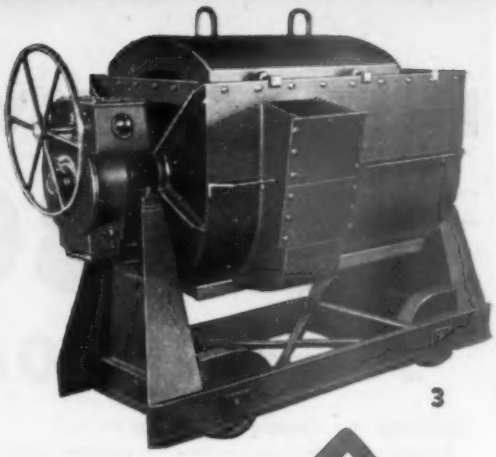

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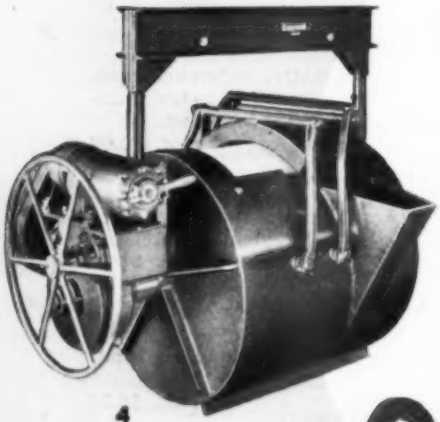

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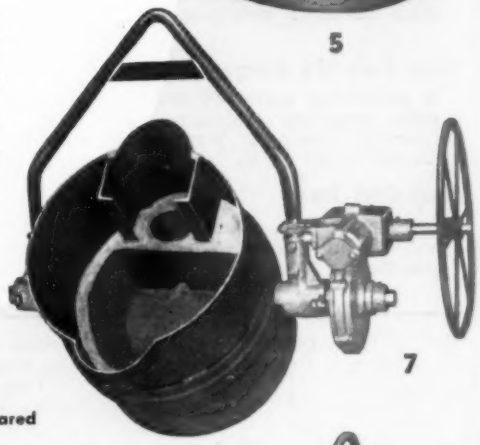

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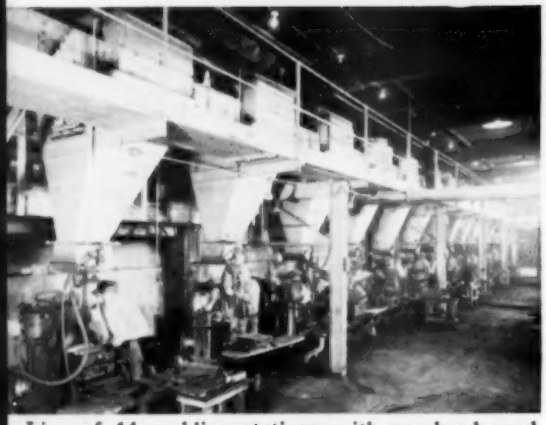
Right: General view of sand handling and preparation unit showing shakeout, elevator and old and new sand storage bins feeding to mixer.



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Pouring zone of mold conveyor, showing three men pouring hot metal into molds which then pass through the ventilated enclosure around to other side of conveyor.

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